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Electrical World

McGraw-Hill Company, Inc.

September 5, 1925

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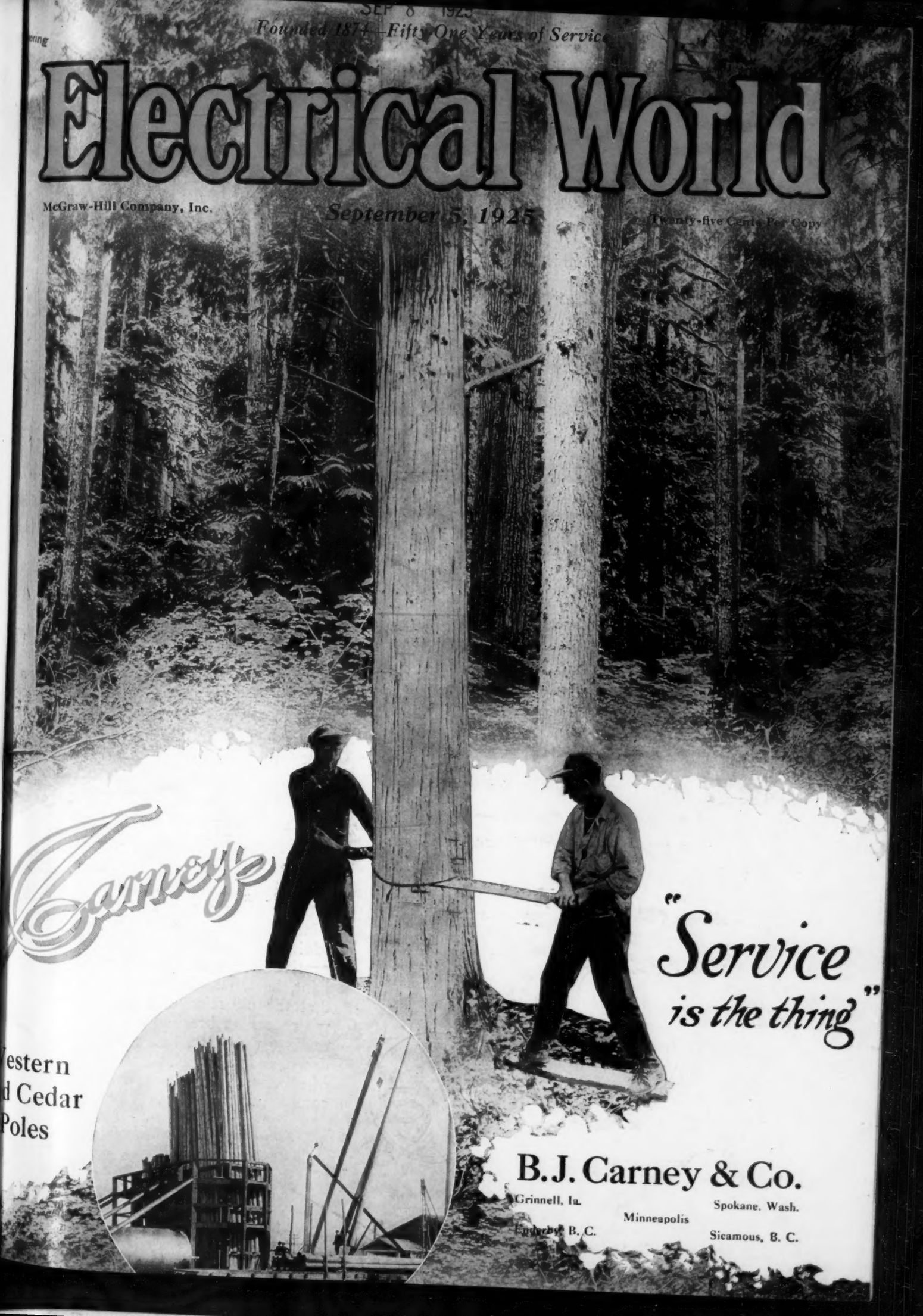

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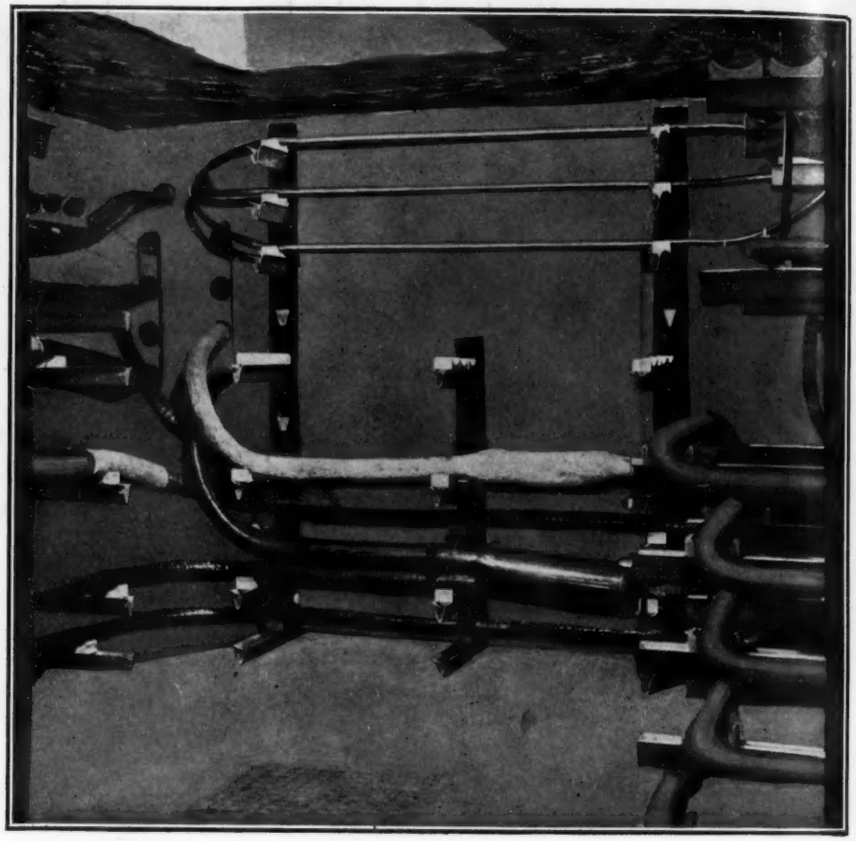

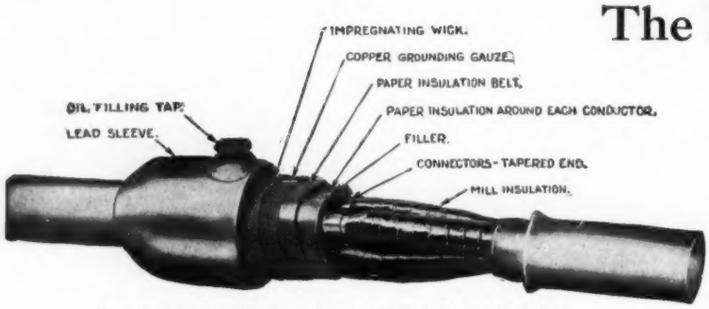

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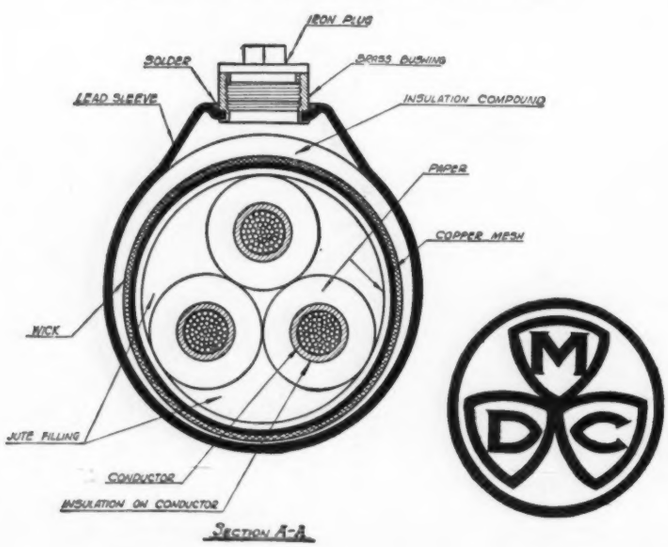

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Electrical World

Published by McGraw-Hill Company, Inc.
W. H. ONKEN, JR.
Editor

VOLUME 86 — *New York, Saturday, September 5, 1925* — NUMBER 10

A Year of New Records

MEASURED by any yardstick the light and power industry has grown greatly during 1925. It has raised $727,057,010 in capital already this year, a sum $100,000,000 greater than that raised by September 1 in 1924. Data available in this issue show that the 29,104,105,000 kw.-hr. generated in the first six months of this year was 8.4 per cent in excess of that generated in the same period last year and indicates an output for the whole year of about 59,000,000,000 kw.-hr. The gross revenue for the six months' period totaled $716,400,000, while operating expenses were $315,000,000.

An interesting feature of the statistics available is that the intracompany business of electric utilities has increased 26 per cent in the last two years. This shows the influence of interconnections and mergers on the operations of the industry. The same movement continues, for, based on the figures for the first six months of 1925, intracompany business promises to be nearly 1,500,000,000 kw.-hr. greater this year than last year.

The building of power stations, transmission lines and distribution systems continues in all parts of the country. Data in this issue show that 951,000 hp. has been added to the developed water power during 1925, bringing the total developed water power to 10,038,000 hp. Of the increase during the year 99 per cent was in electric light and power plants and 1 per cent in manufacturing plants. This is a splendid indication of the trend of power development.

In the manufacturing branches of the industry prospects are also very bright for a good year. A gradual increase in buying in nearly all lines has occurred, and the fall promises splendid business. When the developments of the year come to be summarized on the first of next January, the electrical industry seems sure to show again the establishment of new records in all lines of endeavor.

Economic Habits of Large Centers May Determine Load Factor

EXPRESSION has been given by central-station executives to the view that future increases in system load factor in large centers must come from changes in the economic habits of the community as reflected in established hours of work, demands for transportation and habits of buying. These executives believe that the community as a whole must recognize the high cost of conducting any business under conditions of poor load factor. Even now one hears of plans for operating the public schools throughout the twelve months instead of nine to obtain the economic benefit from utilizing the physical equipment at a 33 per cent improvement in load factor. Plans for greater diversity in transportation demands are under way. Other movements may soon be started.

It must be recognized, however, that the habits of a lifetime cannot be changed like a government. Any alteration will be gradual and exceedingly slow, if indeed it comes at all. But to say that the economic habits of a community must be made over before marked improvement in utility load factor can be experienced denies the responsibility of the sales department in meeting every opportunity for developing those loads that possess an inherently high load factor. The load factor of many central stations is still far below the composite load factor of the commerce and industry of the community, and central-station companies can well afford to strengthen their sales organizations with men who are able to lead in a comprehensive study of the best means for improving it. Others beside electrical men have a vital interest in the question of load factor. It concerns all branches of industry and art. Every intelligent and intensive use of the facilities at hand affects the community in the same way as a more intensive application of tools and appliances. It is measurable in dollars and cents, and the public can be educated to see it. Meanwhile electric light and power men may continue to spread the gospel of better load factor, knowing it possesses a quality like mercy—"it blesses him that gives and him that takes."

Continuity of Service in Interconnection

THE electric power industry has set a very high standard of reliability of service, and expenditures for large factors of safety are justified on all important lines on account of the excessive incidental losses to power users that result from interruptions. But there are some possible causes of interruption existing in the case of overhead high-tension lines which cannot be fully guarded against merely by large factors of safety. Lightning, for example, occasionally causes flashovers on transmission lines in spite of any precautions taken—in fact, lightning has recently been a cause of great annoyance in some districts. The same consideration applies in the case of serious local freshets or the occasional mistakes of human beings and other animals.

Steam reserves, where appropriate, are the remedy usually relied upon. As high-tension interconnections develop, however, many situations occur where steam relays are not practicable. Duplicate plant in the form of steam reserve where most of the power is imported will be uneconomical. In such cases engineers may well consider the practice of supplying each important substation by high-tension lines on separate routes and capable of deriving power from at least two sources. It may be assumed that no cause of interruption, except in the rarest cases, will simultaneously affect all routes or two power houses, so that with suitable relaying continuity of service may be assured.

Single-circuit lines in place of double-circuit con-

struction may with such a practice assist in keeping the cost within reasonable limits. As a matter of fact, an intermediate station on a single-circuit line connected between two main lines has a much more favorable situation from the point of view of reliability of service than a station at the end of a double-circuit line fed from a single substation. In some parts of the country this use of single-circuit lines is very well developed. If reliable service is to be expected, however, they must be connected to supply lines at both ends.

Experience only can tell to what extent such double routing of lines and the use of single circuits may be found available for improving reliability of service and relaxing the necessity for extreme factors of safety and can determine whether the principle of automatic elimination of a faulty line, leaving a self-sufficient alternative, can be substituted for that of infallible construction.

Low-Grade Interconnections Have Their Place

LOW-GRADE interconnections—i.e., those of small capacity on system frontiers—are oftentimes viewed indifferently by many central-station commercial staffs and operating men. Newspaper writers have capitalized these tie-ins to enable their readers to picture continuous copper from Niagara or some other famous hydro-electric development to a distant market for electrical service, but some utility engineers have leaned in the other direction in evaluating these intercompany contacts as contrasted with the heavy capacity, high-voltage trunk line ties which are effecting such savings in modern practice.

It is interesting in traversing the territory from one system to another to observe the electrical distribution facilities taper off until the last street lamp is passed and the last service dropped from the final pole of the rural line. Then may come a gap with a few scattering farms and houses with no wire service or with perhaps a multi-party telephone run from some remote trunk line. Finally one "picks up" the outlying single-phase line of the next company, and the size of the distribution system grows as the density of settlement gains. Now, it is inevitable that local conditions and costs must in large measure control the supply of service to residents of these outlying and intermediate regions; but the desire of such people for electric service involves considerations of public relations as well as an economic issue.

If each company pushes its outlying lines afield to the justified limit and then stops, the situation may become most unsatisfactory. On the other hand, if a frontier interconnection is warranted, even a single-phase tie carrying primary voltage through the open district may prove very advantageous. It may permit serving new customers by means of a meter-reading agreement between the companies; it may result in better service in case of interruptions on one side of the frontier, or it may enable the two companies to supply the area under far better regulation than would be feasible without the tie-in. We believe that it will pay distribution engineers to check up their electrical frontiers in this way with their own sales departments and with the staffs of neighboring companies, and that in many cases it will be found well worth while to eliminate the intercompany non-service zones by installing low-grade connections of first-class design and construction, taking into account, of course, all reasonable opportunities for the use of joint-pole construction and operation among the several utilities that may be interested.

Pit No. 3 Well Designed

THE big development of the Pit River by the Pacific Gas & Electric Company continues to advance the art of electrical engineering. Even a casual reading of the article by E. A. Crellin in this issue shows how thoughtfully the engineers measured all factors before making their decisions upon design. Hydro-electric and transmission engineers can note some great improvements in the design of the new Pit plant as compared with the first plant, but both the development of the art and the difference in operating requirements must be considered when making comparisons.

The arch dam, accessibility to generator and waterwheels, steel liners or forms for draft tubes and simple and convenient control arrangements are outstanding features of the new station. Because of high-tension synchronizing and the cost of potential transformers for 220 kilovolts it was found economical and advisable to use a low-tension bus and low-tension switching. An added advantage of this arrangement was the increased stability of the system when handling charging current under certain load conditions.

The fact that these decisions were made in the light of a critical survey of present-day equipment and practices shows that engineers and manufacturers of equipment still have opportunity to bring about developments before minimum cost, maximum reliability and greatest simplicity will obtain in high-tension hydro station and line installations. The new station is a worthy addition to the contributions of California to the electrical industry, and further plants in this great enterprise of the Pacific Gas & Electric Company are certain to lead the way in the art.

A Masterpiece of Writing and Display

A SET of small folders which the National Electric Light Association has just prepared for distribution to all customers by member companies throughout this country is as fine an example of the right way to go about an important job as the electrical industry has ever seen. They are worth careful study to any executive who has any business message to tell the American public. And few have not.

The problem was to prepare a series of advertisements that could be inclosed with the monthly bills of power companies, something that would tell a few of the important human-interest stories that the public should be told so that it could better understand the job that the electric power industry is doing and realize the importance of listening to facts when the subject of power is up, and not to the unproved words of orators. Here was a chance to set the householder straight on the comparative cost of electric service today, on regulation, on municipal operation, on taxation, on customer ownership, on Muscle Shoals, on Niagara, on other aspects of the subject. It was a bold

conception, considering the number of households to be reached, but an obvious thing to do.

The average man with this purpose in hand would sit down and write a series of arguments—so long and so ponderous that he alone would find them interesting. He would approach the problem from the viewpoint of what *he* desired to say—which is often very different from what the public will desire to read. Yet on the test of attentive reading hangs the result of the entire effort.

The N. E. L. A. is to be congratulated because it had the courage and the common sense to overcome the natural impulse to write the "facty" essays that the electrical industry would naturally enjoy seeing in print and took the job to Bruce Barton, who is a master of the art of making people think, and let him translate the message of the central-station company into simple, lingering thoughts that will attract the average reader, register quickly and sink in.

Out of it have come thirteen little folders for the customer, the taxpayer, the voter, to read as his bills come in month after month for a year. On the front each has a bright, whimsical, forceful cartoon and, hand-lettered boldly in red, a title that stirs curiosity and will make any man or any woman look to see what it's all about. Inside, the message is surprisingly short, but it tells one thing and leaves a very definite well-rounded impression—and with it goes a little chart showing the cheapness of electricity. The four other folders to accompany dividend checks are somewhat longer and heavier, which is all right, for the stockholder will read communications from his company.

No man can seriously debate the value of these folders to every central station—and to the industry. They should be used in every city. And they should be accepted as they are—with no changes made to carry out the whims or theories of any individual. Here is a masterpiece of writing, illustration and display, fashioned expertly to win popular attention. Any company that neglects this opportunity to tell its consumers these vital facts will stand self-convicted of indifference to the interests of both the public and its stockholders. These are strong words but true.

Push Industrial Electric Signs

NATION-WIDE interest in industrial lighting this fall should challenge the best efforts of the electric sign manufacturer, the central-station company and the wiring contractor to develop intensively factory display advertising facing important traffic highways and railroads in local territories inadequately provided with this class of publicity. Recent observation shows that this field of service is far from saturation and that many industrial establishments are still neglecting the most elementary opportunities to identify themselves and their products against the background of darkness which nightly surrounds these places. Never before were so many thousands of the children of men traveling on wheel and rail after dark, and the impression which can now be made by electrical advertising, with its multitude of opportunities for original appeals to interest, should be capitalized for all it is worth.

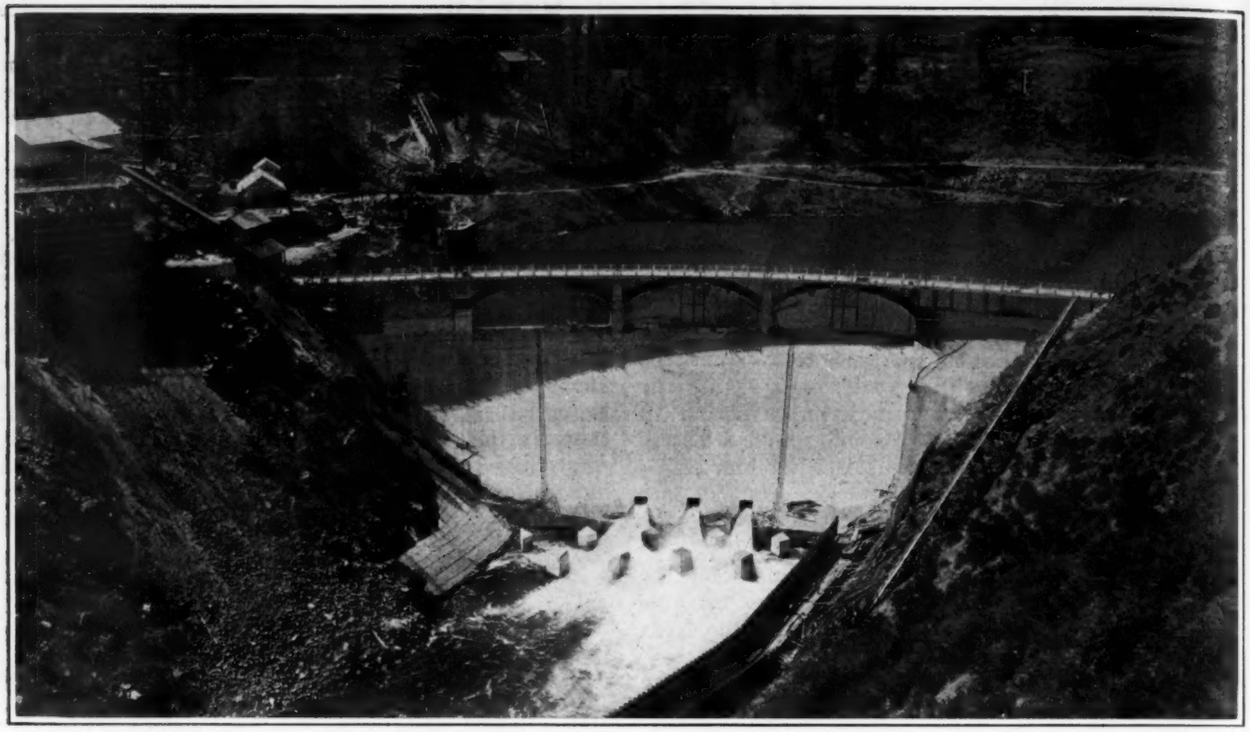
An immense range of design possibilities lies within a hand's reach; costs of installation and operation can be established according to local needs, and time-switch or watchmen's cut-offs can be arranged for maximum convenience and economy. In thousands of factories semi-isolation of buildings insures for modern signs complete temporary monopoly of the eye of the passer. The load is steady and of the long-hour type, tending to improve plant efficiency through its prolongation into off-peak hours. Energetic work done before snow flies will reward the sign user and the electrical man all winter and well into next spring, and even daylight saving leaves time daily for worth-while sign operation. Good signs can be designed, built and erected nowadays at top speed, and there should be a vigorous and determined effort to attract more of this business from manufacturers who do not as yet visualize its benefits, tying in this work with the industrial lighting movement from coast to coast. It has been well said that a big factory with no sign is a wasted opportunity.

The Local Problems and the Leagues

THE fourth annual conference of the representatives of local electrical leagues meets next week at Association Island. Representatives from about sixty leagues will be there as well as delegates from many cities where leagues are in prospect. Nobody knows how far or how fast the league movement is going to go. It is perfectly obvious, however, that the development of local harmony between the different classes of electrical men is of vital importance to the industry and to the public, because there are two conditions affecting the local situation in almost every city that need correction. The contractor as a class is in trouble and the dealer is in trouble. These troubles in both cases are largely of their own making, but nevertheless the other branches of the industry are involved and in part responsible and for their own protection and improvement must lend a hand.

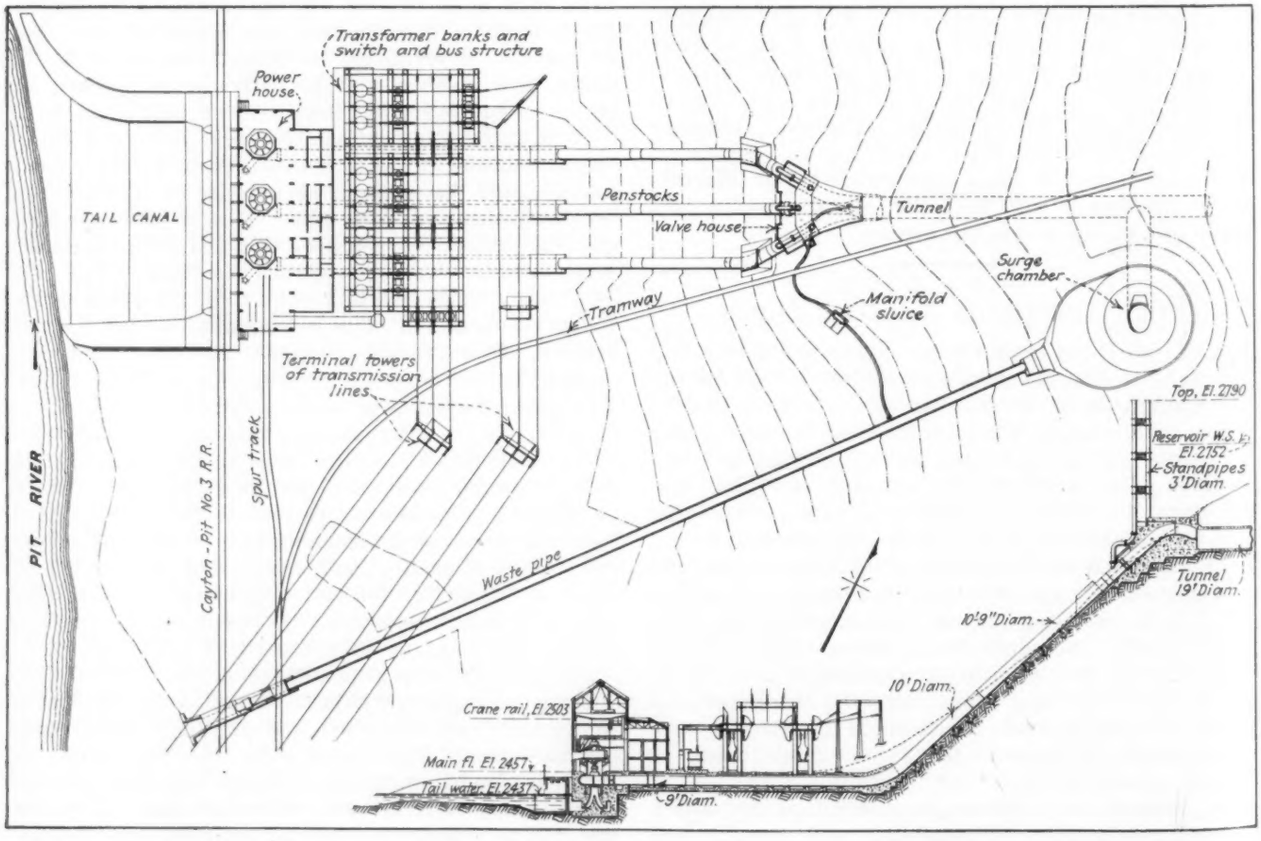
It is imperative that the electrical contractor be inspired somehow to install more adequate wiring systems and to avoid the pauperizing practice of bidding down jobs until the profit is all gone. It is no less imperative that the dealer be encouraged and assisted to become a more aggressive and prosperous merchant. The "Red Seal" plan, which will be a chief topic for discussion at Camp Co-operation, holds out high hopes for the contractor. It is probable that the dealer will come into prosperity only when the flowing volume of local trade in household appliances grows sufficient to support upstanding stocks, and apparently this can come only when the central-station company takes a strong commanding and supporting position in the local market, by educational publicity and creative selling, that will establish high standards of merchandising practice and proper recognition of quality and price levels and, above all, build up popularity for electrical household equipment that will bring volume to the business, for without volume there can be no prosperity for any dealer.

All this will come gradually. But when it does come—here, there and everywhere—it will be the product of co-operation, co-ordination and harmony among local electrical men. The league offers the best visible instrument for bringing this about and as such deserves earnest support from every electrical man. In fostering this movement the Society for Electrical Development is doing a most important service to the industry.



Pit No. 3 Plant Completed

THE second of a series of plants planned by the Pacific Gas & Electric Company along the Pit River in northern California was placed in operation in July. The station has three Francis waterwheels rated at 33,100 hp. each, direct connected to three 27,000-kva. General Electric a.c. generators. Power developed at the new plant will be transmitted to San Francisco over the same 220,000-volt line that carries the power developed at Pit No. 1, which is rated at 70,000 kva.



International High-Tension Systems

Practices Compared and Opinions Given—Little Agreement on Standards—Cables, Machines, Lightning and Interconnection Stressed—Many New Developments Announced and Proposals Made for Changing Practice

THE third Paris conference on high-tension systems, held June 16-25 this year, was attended by about three hundred French engineers and more than two hundred delegates from other countries, including representatives of the International Electrotechnical Commission and of a great number of national engineering bodies. In all, twenty-five different countries were represented. Great Britain, Belgium and Italy sent very strong delegations. There were no German names on the list, but the Russian delegates took an active part in the proceedings. English and French were both official languages, every contribution given in one language being translated into the other by interpreters.

The first in this series of international conferences in Paris on large high-tension power systems was held in 1921 and dealt with a great number of detail questions. On that occasion also a considerable amount of electrical and descriptive material was brought together from different countries. The second conference was convened in 1923 and devoted its attention almost exclusively to the design and operation of transmission lines.

At this year's conference the program mainly concerned matters pertaining to the operation and administration of large power systems. The ninety-odd reports presented grouped themselves around certain important questions of great common interest, such as parallel operation of large power systems, intercommunication between power stations, protective apparatus, inductive interference and international rules for the testing of oil and cable and for the construction of transmission line.

It is above all in Italy that the problem of interconnection and parallel operation of large power systems has grown to be of primary importance. The several hundred power stations in northern Italy have been combined into a few very important power groups, and within these groups, and between them, a very important exchange of power is taking place. It is clear that the advantages of a rational load-dispatching service are particularly great in this region. Some of the power stations are of the flow-of-river type, while others operate on heads as high as 3,000 ft. and have reservoirs large enough to take in the whole year's precipitation. These conditions, and some of the problems which they have given rise to, were outlined in several reports presented at the conference by Italian engineers, which contained very interesting practical examples.

Thus, C. Pellizzari, in dealing with the question of power interchange between systems of different frequencies, stated that in Italy, where systems of 42, 45 and 50 cycles are intermingled, it has been found more economical to operate the stations in groups according to frequency and establish wholesale power interchange between these groups than to change over to one standard frequency. A number of two-frequency interconnecting links are already in operation. For the Predare power station, for instance, there are installed two units of 6,000 kva., each consisting of one synchronous machine for 42 cycles and another for 50 cycles, directly connected to a 4,400-kw. turbine, and one similar group of 9,000 kva. with a 6,600-kw. turbine. Similar installations at Esterle and at Bergamo were also described.

An interesting application of the Scherbius regulator was made in Bardonecchia. Three 2,000-kva. units, consisting of one 50-cycle induction motor and one 16-17-cycle synchronous generator, were used for many years to connect the municipal power system of Turin with the 16-cycle supply of the state railroads. These converters were provided with huge wheels, and the Scherbius regulator adjusted the speed within a 20 per cent margin so that the energy stored in the wheels could be used for starting up tramways on the 16-cycle side, thus preventing sudden load peaks being thrown on the 50-cycle system.

Another device used in some large stations belonging to the Breda Company, and which is to be applied in several other plants now under construction, consists in designing the hydro-electric generator sets so that they may be used equally well at 42 cycles and at 50 cycles. M. Langlois (France) described a 15,000-kw. turbo-alternator for either 25 cycles or 50 cycles, where the windings could be connected in two ways.

Repartition of Load

Two French engineers, E. Roth and G. Belfils, described an interesting method for regulating the repartition of load between parallel feeders. In one of the branches is inserted the secondary of a transformer fed by a synchronous generator which has two separate excitation windings, displaced 90 electrical degrees along the circumference of the armature. The generator is driven by a slightly oversized synchronous motor, and by regulating independently the currents in the two excitation windings a voltage of any size and phase may be introduced in the circuit formed by the two parallel feeders, and by this means the division of current can be influenced. The device is said to be of special importance in cases where it is necessary for switching purposes to bring down the load on one of the feeders to zero.

Theoretical papers bearing upon the calculation of alternating-current systems were presented by G. Sartori (Italy), R. Lundholm (Sweden) and G. Darrieus (France).

The question of stability between interconnected power stations was discussed by Th. Bakker and van Staveren (Holland), and various oscillation phenomena were practically demonstrated by means of a transmission model so designed that the phase angle between the two small synchronous generators, representing the two stations, could be visually observed.

In dealing with electric disturbances, Ch. Lavanchy (France) described a very remarkable case of fifth-harmonic resonance on a 120,000-volt line in the lower Isère, and Barbagelata and Soldini (Italy) described a

selective disconnecting device, due to Modigliani, which has been applied recently in Italy. This relay works on the differential principle and consists essentially of induction-type wattmeters, which are mechanically interconnected, one wattmeter being placed in each phase of the machine or in each one of the parallel feeders to be protected. The worm gear in this relay is free to move upward so that if one of the relays attains a greater speed than the others in the group, its worm gear will begin to screw itself upward, finally closing a contact which trips the breaker.

In a paper by H. Norinder were reported the latest results of the thunderstorm researches carried out by the Royal Board of Waterfalls in Sweden. The paper contains about a hundred oscillograms of the atmospheric field during lightning discharges, which show that the lightning is an aperiodic phenomenon taking place within a time of two five-hundredths of a second. G. Faccioli (United States) described the results obtained with the "lightning generator" in Pittsfield, Mass. In connection with these reports and with a report on insulator design and testing presented by J. L. Langton (Great Britain) a rather heated discussion arose as to the relative merits of the German impact and the high-frequency-impulse method of testing insulators, A. O. Austin of America upholding the high-frequency method as a sure means of detecting accidental air pockets within the insulators.

INTERCOMMUNICATION BETWEEN STATIONS

The question of intercommunication between power stations received considerable attention at the conference. M. Chireix, R. Dubois and E. O. Meyer (France) described experiences with carrier-current telephoning on high-tension lines made by different companies in France. They remarked that as a rule these experiences were of a rather discouraging nature, leading in some cases even to the conclusion that a straightforward space-radio communication was the preferable solution. The space radio has been developed rather as a French specialty and is operating satisfactorily in many quarters, for instance in the Lyons Gas & Electric Company system, where no less than four radio-telephone stations are in continuous operation in the main office and the big central stations surrounding Lyons. The wired telephone system, with telephone conductors strung upon the transmission-line towers, which is much used in France up to great distances, also seems to have caused much disappointment. Y. West of the Strassbourg Electric Power Company, in describing some special apparatus developed by the Thomson-Houston Company in Paris, emphasized the necessity of employing only first-class material, designed for this particular purpose, instead of using, as has been done in many cases, ordinary telephone equipment for the transmission-line telephone circuits.

In reviewing the latest developments in the high-tension-cable field L. Emanueli (Italy) stated that an experimental high-tension cable consisting of three single-phase branches, about half a mile long, has been in regular operation in Italy at 130,000 volts ever since October last year. This cable is of a new type with oil impregnation, the oil standing under pressure from oil conservators along the cable.

P. Dunsheath (Great Britain) pointed out that so far the cable had been subjected only to very low current loads and said it would be of great interest to learn more about the behavior of the cable when under varying current load since it probably is the dilatation and contraction of the copper core which is the most dangerous factor. Mr. Emanueli corroborated this statement and said that cable faults usually occur at low loads. He mentioned that the oil-impregnated Pirelli cable is to be tried on a larger scale in America, as the New York Edison Company has ordered an 111,000-volt cable, 12 miles long, intended to transmit 90,000 kw.

Several reports concerning international regulations for power lines were discussed at the conference. The Belgian delegation presented an extremely detailed draft of proposed specifications, suggesting as a basis for mechanical calculation (a) a temperature of 15 deg. C. with a wind pressure of 120 kg. per square meter of exposed surface, and (b) a temperature of 15 deg. C. with a wind pressure of 30 kg. per square meter, the reduction factor for round conductor being 0.6. Under these conditions the following safety factors should apply: Three for conductors and steel poles, three and one-half for reinforced concrete, ten for wooden poles and five for wooden poles effectively protected from any deteriorating action of the soil.

In another report a résumé was given of a set of new line regulations recently adopted in Sweden and involving certain new principles. The country is divided into different temperature zones and ice-load zones, to which are assigned different minimum temperatures and ice-load values, one set for normally severe weather and another set corresponding to extremely severe load conditions which very seldom occur. The lines are classed according to their importance, beginning with trunk lines and main lines of primary importance and ending with rural-extension lines where an interruption is of minor economic importance. Only for the most important classes of lines is it required that severe loading conditions be applied. The factor of safety, however, is the same for all classes of lines, but is different for different parts of the structure.

Quite another point of view was taken by G. W. Twiss (Great Britain) in a report where he compared the standard rules applied in different countries. The stresses in a 150-m. span of different standard cables, strung according to the various regulations, which would remain when all external load was removed and the temperature was raised to 50 deg. C. was computed and plotted. Such a comparison showed, Mr. Twiss said, that all these different regulations give curves lying within a relatively narrow range, and this fact can be made use of to create a uniform line standard independent of arbitrary safety factors and complicated load conditions.

The various proposals regarding transmission-line standards were discussed by a special committee, but no decision was taken at the conference.

INDUCTIVE INTERFERENCE

Another group of papers dealt with inductive interference. Prof. E. Brylinsky (France) gave a comprehensive review of the whole problem of interference in telecommunication lines from neighboring high-tension transmission lines, ending with a résumé of certain advisory rules drawn up by the International Telephone Committee. G. Valensi (France) showed how the telephone lines ought to be built in order to obviate interference and described methods for directly measuring parasitic voltages. Both speakers stressed the importance of acoustic shocks which the telephone operators

may be subjected to if a tension of 300 volts is induced in the telephone line so that the vacuum-tube lightning arresters function. It was shown by experiments that even one one-hundredth of a joule, when passed through a telephone receiver, give an acoustic shock which may be quite dangerous.

H. V. Schuler (Switzerland) considered the problem especially from the point of view of electric alternating-current railways and dealt with the effect of suction transformers in the rail circuit. According to Swiss experience, the only effective remedy against disturbances from the contact wire is to move the telephone lines 4 km. or 5 km. away from the railway or to place them in cables.

In Switzerland numerous experiments also have been made to determine the effect of a grounded neutral upon the inductive interference from a faulty transmission line, and these experiments were described in a voluminous report by Bauer, Forrer and Rump.

The proposed rules for power lines paralleling telephone circuits gave rise to much discussion, but several speakers warned against taking a vote of adherence and no action followed.

[The secretary-general of the conference reported above writes to the ELECTRICAL WORLD that the official proceedings will fill two volumes of 1,100 pages each and that to meet the expense of publication at least 1,000 subscriptions at 200 francs each must be secured. All who desire a copy of the proceedings are therefore urged to send their order at once, accompanied by the remittance, to the Conference Internationale des Grands Réseaux Electriques, 25 Boulevard Malesherbes, Paris.]

Forecasting Line Extension Profits

Equation Based on Yearly Cost Analyses Facilitates Decisions in Customer Negotiations—Economic Computations Made in Presence of Applicants for Service

By W. A. FORBUSH

General Superintendent Edison Electric Illuminating Company, Brockton, Mass.

THE PROBLEM of properly handling requests for service extensions is continually before operating companies. It is universally accepted that the making of extensions that are in themselves unprofitable is economically unjustifiable. Losses incurred by such extensions must be made good by present customers and, if large enough, must increase rates. Therefore it is our desire to be able to judge accurately the effect of each proposed extension on both income and expenses. In our company we have studied the matter for years and have developed a method that we are now using and that we have found satisfactory.

We call the method the application of the extension equation, although in the form now used the equation, as such, does not appear directly. The development of the method was briefly as follows:

First, to be profitable, the revenue received from any extension must exceed the fixed cost of the extension investment, of the proportionate substation and station investment, plus the expense of operating and maintaining the wires, transformers and meters, plus the cost of energy delivered to the extension. The energy cost used includes the cost at the distribution bus, plus the distribution losses, plus a charge for certain general expenses, which have been distributed on a kilowatt-hour basis.

We expressed the above statement in this form:

$$R = A \times I + B \times C + D \times L + E \times T + F \times M + K \times N \times H$$

where

A = Annual fixed charge on extension, expressed as a decimal.
B = Annual fixed charge on substation and station capacity per kilowatt of connected load.
C = Connected load on extension in kilowatts.
D = Annual cost per foot for operating and maintaining lines (includes depreciation).
E = Annual cost per unit for operating and maintaining transformers (includes depreciation).
F = Annual cost per unit for operating and maintaining meters (includes depreciation).
H = Cost per kilowatt-hour of energy at the distribution bus.
I = Extension investment.
K = Per cent distribution loss plus unity (for example, 1.30 for 30 per cent loss).
L = Feet of wire in the line (irrespective of size).
M = Number of meters.
N = Number of kilowatt-hours of annual consumption.
R = Annual revenue.
T = Number of transformers.

Next were obtained figures with which to replace the constants in the equation. The figures here given are not actual unit costs, but are representative of what these might be and give us units that may be used in demonstrating the application of the method. Each company must calculate these for itself.

For A, or the annual fixed charge on the extension, take 12 per cent, or 0.12. This includes interest and taxes, but not depreciation, as that is covered in the line and transformer units.

B, or the annual fixed costs on station and substation capacity per kilowatt of connected load, is probably the most difficult to arrive at accurately. To obtain this we took tests covering large areas, checking the sectional diversity factors back through transformers, feeders, substation and station to obtain our actual total diversity factor. This will vary for different companies. For the purpose of this explanation, we shall call it 20 per cent. This must be applied to the company's actual investment as shown in its financial report, resolved to a figure giving resultant cost per kilowatt of capacity. On this we take an annual fixed cost at a rate that includes interest, taxes and depreciation. This gives the resultant annual cost of capacity per kilowatt of connected load.

The constants were built up as follows:

One kilowatt of connected load, due to 20 per cent total diversity factor, requires 0.2 kw. of station and substation capacity. If this capacity represents an investment of $225 per kilowatt, then 0.2 × $225 gives $45 investment per kilowatt of connected load. If the annual fixed cost is 20 per cent, then 20 per cent of $45 gives $9, the annual cost per kilowatt of connected load.

C, the connected load on the extension in kilowatts, is of course, estimated for each individual case.

D, the annual cost per foot of wire for operating and maintaining lines, including depreciation, was arrived at for our company by taking the total annual charges to accounts* 638A, 638B, 639, 647, 648 and 649 and dividing by the total feet of wire, as shown on the annual report. For this explanation, we can take a unit cost of $0.0045.

638A—Transmission and distribution superintendence.
638B—Transmission and distribution labor.
639—Transmission and distribution supplies and expenses.
647—Transmission and distribution lines, overhead.
648—Underground conduit.
649—Underground conductors.

E, the annual cost per unit for operating and maintaining transformers, including depreciation, is similar to the line cost. The total charges to accounts 642 and 651 were divided by the total number of transformers, giving the resultant unit figure, here taken as $2.50.

642—Removing and resetting transformers.
651—Maintenance of transformers.

F, the annual cost per unit for meters, is also similar. The total charges to accounts 640A, 640B, 641, 650, 660A and 661A were divided by the total number of meters, giving the resultant unit figure, here shown as $0.90.

640A—Meter department labor.
640B—Meter department supplies and expenses.
641—Removing and resetting meters.
650—Maintenance of consumers' meters.
660A—Meter readers' salaries.
661A—Meter reading supplies and expenses.

H, the cost of energy at the distribution bus, includes costs for generation, substation operating and maintenance and general expense, being accounts numbers 601 to 617 inclusive, 636A, 636B, 637, 645, 646, 662 to 677C inclusive. The total of these accounts was divided by the annual net output in kilowatt-hours to give a figure for energy cost at the distribution bus, here shown as $0.014 per kilowatt-hour.

601—Superintendence.
602—Boiler labor.
603—Engine labor.
604—Electrical labor.
605—Miscellaneous labor.
606—Boiler fuel.
607—Water for steam.
608—Lubricants.
609—Station supplies and expenses.
610—Steam from other sources.
611—Maintenance of station structures.
612A—Maintenance of boilers and boiler equipment.
612B—Maintenance of coal- and ash-handling equipment.
613—Maintenance of steam engines.
614—Maintenance of turbo-generator units.
615—Maintenance of electric generating equipment.
616—Maintenance of accessory electric equipment.
617—Maintenance of miscellaneous power plant equipment.
636A—Transformers and substation superintendence.
636B—Transformer and substation labor.
637—Transformer and substation supplies and expenses.
645—Maintenance of transformer and substation structures.
646—Maintenance of transformer and substation equipment.
662—New business.
677C—Stores department.

*Massachusetts Department of Public Utilities Classification.

I, the extension investment for each proposed extension, is taken from the construction estimate.

K is the per cent of distribution loss for any system plus unity. Here it is given as 1.15, showing a 15 per cent loss.

L, the feet of wire, comes from the construction estimate, as does the number of meters and transformers.

The estimated income and kilowatt-hour use is made by the commercial department.

TABLE I—COST AND REVENUE OF TYPICAL LINE EXTENSION

Extension on	Water Street
To serve	15 small residences
Extension data	
Investment	$1,200
Number of customers	15
Estimated income	$400
Estimated kilowatt-hour use	5,000
Estimated connected load, number customers × 0.5 kw. average. (15×0.5)	7.5
Number of transformers	2
Number of meters	15
Number of feet of wire	13,000

Application of Average Costs

Annual Cost of	Average Cost	Extension Unit	
Investment	12%	× $1,200	= $144.00
Capacity	$9.00	× connected load in kilowatts (7.5)	= 67.50
Wire	0.0045	× feet of wire (13,000)	= 55.50
Transformers	2.50	× number transformers (2)	= 5.00
Meters	.90	× number meters (15)	= 13.50
Per customer	2.00	× number customers (15)	= 30.00
Energy losses	.014	× 1.15 (losses) × killowatt-hours (5,000)	= 80.50
Net annual cost			396.00
Net annual income			400.00
Total annual profit or loss (profit)			4.00

As the equation has been used, we have modified it slightly by adding an annual per customer charge for commercial expenses, which is the total of accounts 656, 658, 659, 660B and 661B, divided by the total number of customers. This can be taken here as $2 per customer per year.

656—Commercial lamps.
658—Commercial lighting equipment.
659—Consumers' installations.
660B—Accounting and collection salaries.
661B—Accounting and collection supplies.

In our own case, we believe that we should use actual figures for more than one year in obtaining the above unit figures. Consequently, our method is to find these figures for each calendar year and then to take as our standard unit the average of the last five years.

So far this gives the equation and figures to be used in applying it. Experience in its application has shown that a modified form gives the story in a shape that is more readily understood by the prospective customer. We now use a mimeographed form shown in Table I, applied to a typical case.

Such a form can be worked out before the applicant; he can see that each item listed represents an actual cost and when the unit figures used are based on five-year averages of the actual figures given in the annual state report, their accuracy is not questioned.

If the net results show a loss, the applicant may pay a part of the initial investment, or may guarantee a larger minimum annual payment.

The method is not perfect, but over a period of years it has given better mutual satisfaction than any other known to us.

Engineering Features of Pit No. 3

Second Step in Half Million Horsepower Development Completed—Development Scheme and 220-Kv. Transmission Influence Choice of Units—Operation Efficiency and Economy Prime Factors in Design of Plant

By E. A. CRELLIN

Assistant Engineer, Division of Hydro-electric and Transmission Engineering, Pacific Gas & Electric Company, San Francisco

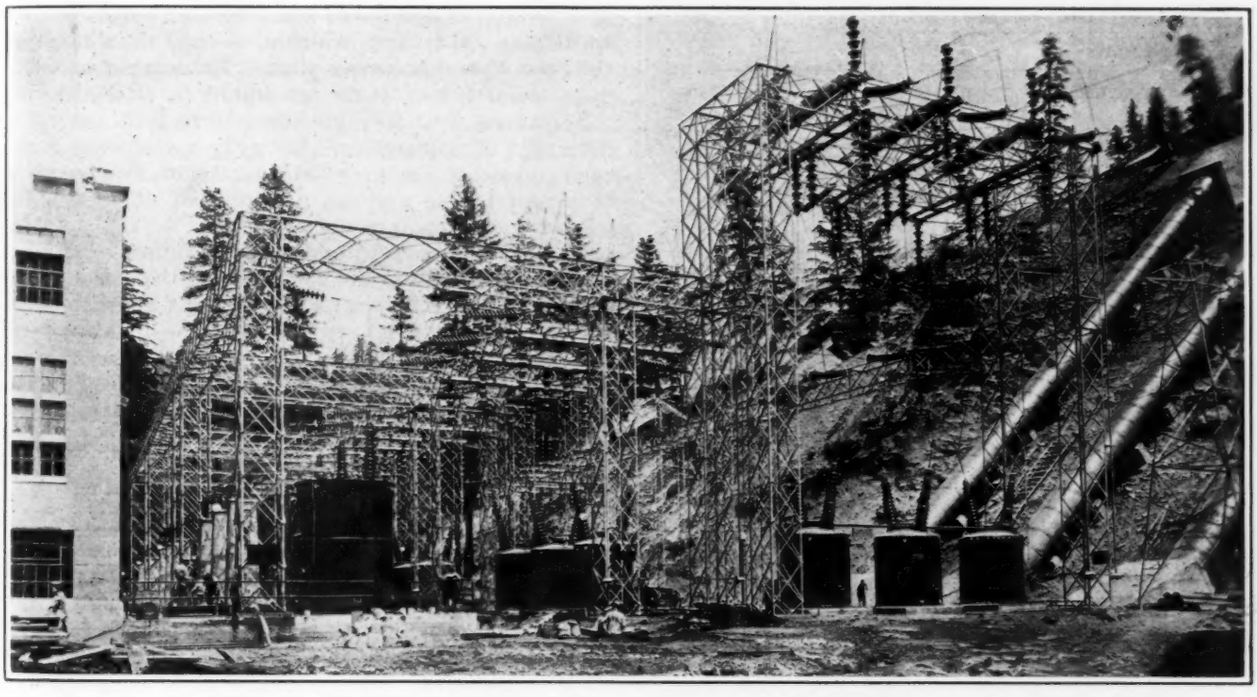


FIG. 1—SWITCH STRUCTURE AND VIEW OF PENSTOCKS

COMPLETION of the Pit River No. 3 plant of the Pacific Gas & Electric Company, and its formal dedication on July 18, 1925, mark the second step in a half million horsepower development program on Pit River in northern California. The complete development[1] (see Fig. 5) contemplates a chain of plants that will utilize 2,100 ft. of head in 60 miles of the upper reaches of Pit River. With such an arrangement of plants, where the tailrace of one becomes the forebay of the next, consideration must be given to the individual plants in order that the most economical use of water may be had. Such factors as the number of units to be installed must be considered from the standpoint of supplying water to the plants downstream with one unit out of commission for inspection or repairs, as well as from the standpoint of economical first cost and flexibility within the plant itself.

Because of the remarkably uniform flow of Pit River, the plants are operated as "run of river" plants, taking all the water available continuously and peaking only within the narrow limits afforded by the water impounded between the tailraces and intakes of the several plants. Thus each plant in a measure affects all the plants below it, and careful study must be made to obtain the maximum reliability in order to minimize shutdowns with a consequent reduction in the water flowing through the plant and resultant decrease of water supplied to the downstream plants.

[1]See "Half Million Horsepower from Pit River," by A. H. Markwart, ELECTRICAL WORLD, March 12, 1921. "The Pit River Power and 220,000-Volt Transmission Problems," by F. G. Baum, ELECTRICAL WORLD, Jan. 27, 1923. "Pit River Power Developments," by F. G. Baum and S. Barfoed, ELECTRICAL WORLD, Feb. 3, 1923.

HYDRAULIC FEATURES OF PIT NO. 3

The diversion for Pit 3 is made by a concrete gravity ogee section dam arched in plan to a radius of 500 ft. and having a spillway portion of 267 ft. capable of passing floods of 70,000 cu.ft. per second without overtopping the ends of the dam. This is nearly three times the maximum flood yet recorded. To prevent erosion of the stream bed when floods are passing over the crest, an extensive apron has been constructed below the dam. On the apron there are a group of baffle piers designed to absorb the greater portion of the energy of this swiftly moving water. The dam proper is 112 ft. high from foundation level to spillway crest. Water is backed up in the Pit River approximately 9 miles to the tailrace of the proposed Pit River No. 2 plant and forms a reservoir of about 32,500 acre-feet capacity. Three sluice gates each 7 ft. square in the bottom of the dam permit unwatering the reservoir, should this become necessary. These gates are operated by oil cylinders supplied with oil under high pressure from motor-driven pumps located in a gallery inside the dam.

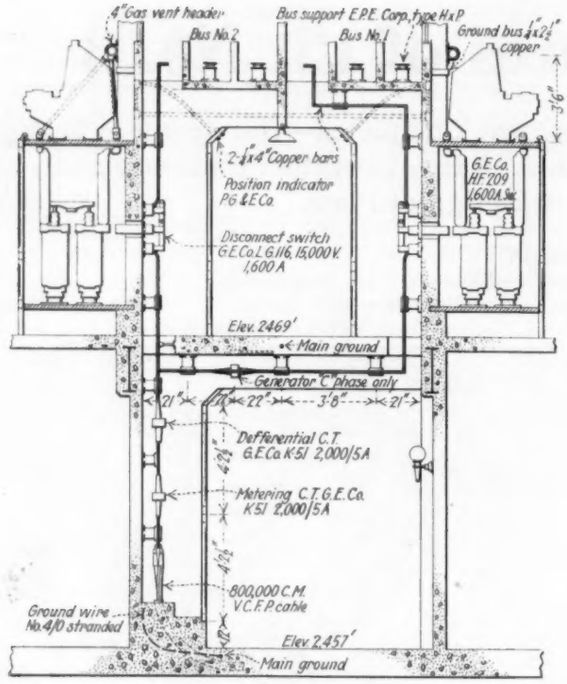

4" Gas vent header
Bus support E.P.E. Corp. type H x P
Bus No. 2
Bus No. 1
Ground bus ¼" x 2½" copper
2-¼" x 4" Copper bars
Position indicator P.G. & E. Co.
G.E. Co. HF 209 1,600 A. Sw.
Disconnect switch G.E. Co. L.G. 116, 15,000 V. 1,600 A
Elev. 2469'
Main ground
Generator "C" phase only
Differential C.T. G.E. Co. K 5I 2,000/5 A
Metering C.T. G.E. Co. K 5I 2,000/5 A
800,000 C.M. V.C.F.P. cable
Ground wire No. 4/0 stranded
Elev. 2457'
Main ground

Fig. 2

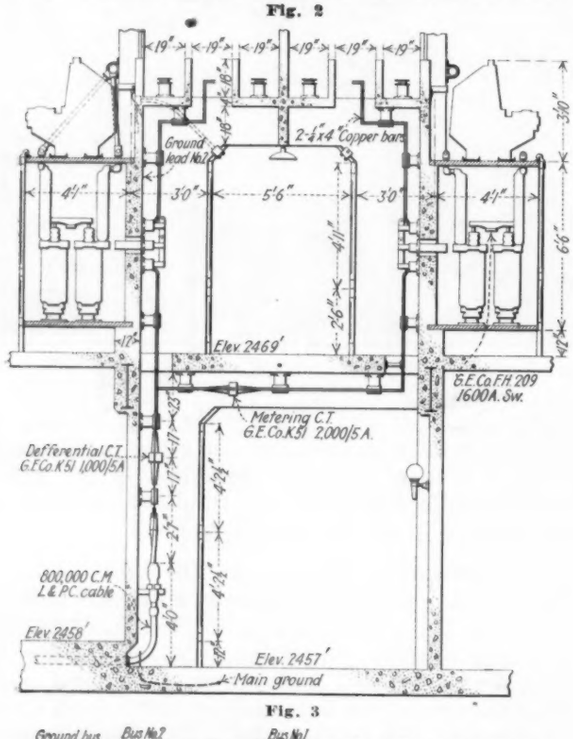

Ground lead No. 2
2-¼" x 4" Copper bars
Elev. 2469'
G.E. Co. FH 209 1600 A. Sw.
Metering C.T. G.E. Co. K 5I 2,000/5 A.
Differential C.T. G.E. Co. K 5I 1,000/5 A
800,000 C.M. L. & P.C. cable
Elev. 2458'
Elev. 2457'
Main ground

Fig. 3

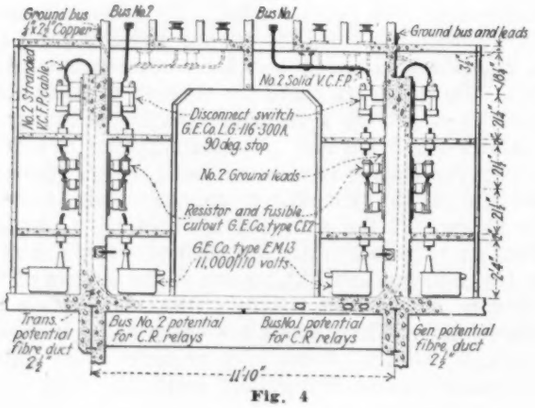

Ground bus ¼" x 2½" Copper
Bus No. 2
Bus No. 1
Ground bus and leads
No. 2 Stranded V.C.F.P. cable
No. 2 Solid V.C.F.P.
Disconnect switch G.E. Co. L.G. 116 300 A. 90 deg. stop
No. 2 Ground leads
Resistor and fusible cutout G.E. Co. type C.I.T.
G.E. Co. type E.M. 13 11,000/110 volts
Trans. potential Fibre duct 2½"
Bus No. 2 potential for C.R. relays
Bus No. 1 potential for C.R. relays
Gen potential fibre duct 2½"
11'10"

Fig. 4

The water impounded enters a concrete-lined tunnel 19 ft. in diameter and approximately 4 miles long. The intake structure contains two large cast-iron headgates 8 ft. wide and 18 ft. high, with an extensive screen or grizzly placed just upstream from the gates to prevent entrance of débris. A reinforced concrete surge chamber is located near the power plant end of the tunnel. A plan and profile of power house, penstocks and surge chamber is shown on page 450. The surge chamber is 64 ft. in diameter at the bottom with ¼ to 1 side slope for height of 60 ft. The upper 27 ft. is a cylinder 94 ft. in diameter. In the event of sudden rejection of load by the plant water flows over the spillway lip of the surge chamber and enters a steel waste pipe 900 ft. long, which discharges the water into the river above the power plant. The waste pipe has a diameter of 120 in. at the top and 87 in. at the bottom.

The tunnel branches into three 10 ft. 9 in. penstocks by means of a manifold. Butterfly valves having the same diameter are provided just below the manifold to permit taking any one penstock out of service for inspection or repair without shutting down the entire plant. The three penstocks continue down a 42 deg. slope about 300 ft. to the flat on which the power house is located. Here they enter tunnels each approximately 200 ft. long, for final connection to the turbines. At the entrance to the power house the penstocks are reduced in size to 9 ft. There is a 9-ft. butterfly valve at the entrance to each turbine to permit inspection of the unit without draining the penstock.

HYDRAULIC TURBINES

The plant contains three 33,100-hp., Francis type turbines, built by the Pelton Water Wheel Company of San Francisco, housed in a building 192 ft. long by 45 ft. wide. A photographic cross-section of one of the units is shown in Fig. 9. A three-story section 160 ft. high and 36 ft. wide houses the 11,000-volt bus and the main switchboard. When design work on the plant was started, it was decided it would not be usual practice to charge the 220-kv. transmission lines from this plant, but that Pit 1 would continue to perform this function with its two 35,000-kva. generators. Thus the selection of generator size was a matter of operating economies entirely. Pit 1 was the first plant to be built where the charging of 220-kv. transmission lines was an important consideration. In that plant the minimum size was fixed at 35,000 kva. and small latitude was given engineers in the choice of unit size.

At Pit 3 during times of maximum stream flow and during the short daily peak, there will be available approximately 2,400 sec.-ft. of water. Studies on the best division of units led to the choice of three units, each capable of operating on 1,050 sec.-ft. under an effective head of 307 ft. (two units operating for average conditions) or on 1,000-sec.-ft. under a head of 280 ft. (three units for maximum tunnel capacity). This gives ample margin for repair and inspection shutdowns. Under these conditions the units have a rating of 33,000 hp. under a head of 307 ft., or 29,000 hp. under a head of 280 ft. The turbines have a specific speed of 33.2 and operate at 225 r.p.m.

FIGS. 2, 3 AND 4—TYPICAL CROSS-SECTIONS THROUGH 11,000-VOLT SWITCH AND BUS STRUCTURE

Fig. 2—Cross-section through generator cell.
Fig. 3—Cross-section through transformer cell.
Fig. 4—Cross-section through potential transformer cell.

The 9-ft. butterfly valves previously mentioned are motor operated with push-button stations located near the valve motors as well as on the main floor. In addition push-button stations for closing only are located on the switchboard floor. The same arrangement is used at the upper end of the penstocks. Automatic push-button stations are located in the upper valve house. There are emergency stations, for closing only on the switchboard in the power house. Provision has also been made for hand operation of the valves.

Each turbine is equipped with a relief valve capable of bypassing 80 per cent of the water taken by the turbine with full gate opening. The relief valves are normally operated on the water-saving basis, but may be changed over for synchronous bypass operation if desired.

The governors were built by the manufacturer of the turbines. Instead of the usual belted arrangement, they are driven by direct mechanical drive through a spiral gear and pinion from the main turbine shaft. The governor drive shaft is loaded with the guide-bearing oil

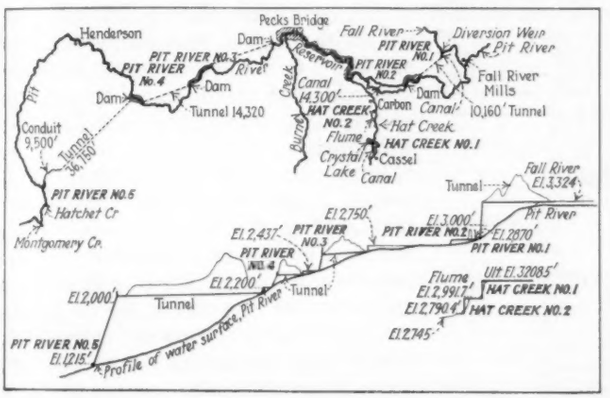


FIG. 5—MAP AND PROFILE OF HALF-MILLION HORSEPOWER PIT RIVER DEVELOPMENT OF PACIFIC GAS & ELECTRIC COMPANY

pump in order to steady its operation. Complete remote control permits starting or stopping a unit from the main switchboard. A solenoid actuated from relays or an emergency pull-button switch on the main switchboard provides for emergency shutdown.

It is the usual practice on the system of the Pacific Gas & Electric Company for one hydro plant to do the governing for the entire system, the remainder of the plants taking a given block load and carrying it continuously under orders from the load dispatcher. To permit this the governors are equipped with remote control load-limiting devices for blocking out the load to be carried. Both the gate-opening control and the load-limiting device are operated from the main control benchboard. The per cent gate opening and the position of the load-limiting device are shown on meters of the switchboard type mounted on the same panel with the generator instruments.

There are individual governor oil-pumping sets for each unit mounted on the main floor near their respective units. These sets are made up of the following: two independent gear pumps, one driven by an electric motor and the other by a water motor, all mounted on a common bed plate; one sump tank; a self-priming strainer for each pump; one pressure tank; one unloader, and the necessary valves and fittings to enable either pump to draw oil from the sump and deliver it to the pressure tank.

The Pelton Water Wheel Company's contract price

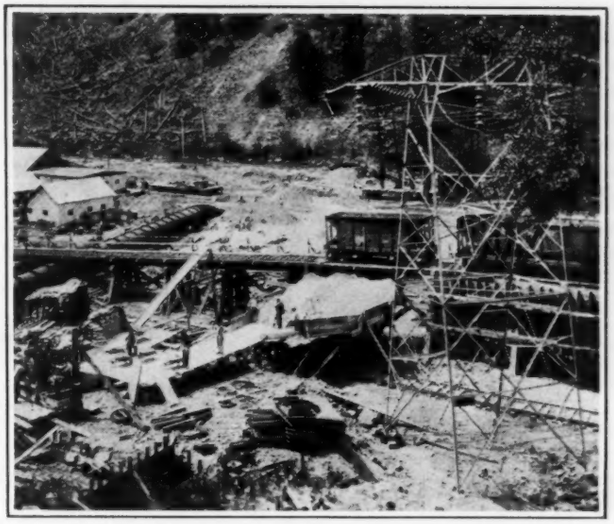


FIG. 6—VIEW DURING CONSTRUCTION

included a license to use the Moody spreading draft tube, which consists of a central cone inside the draft tube proper. The section of the draft tube immediately below the runner is of cast iron and so designed that it can be readily removed, thus permitting the removal of the turbine runner without disturbing the generator. The remainder of the draft tube, including the central cone, is of reinforced concrete. Construction of draft tubes for units of this size is expensive. The bulk of concrete required is exceedingly heavy and necessitates heavy form work. If the guarantees of the turbine maker are to be met, great care must be taken to adhere

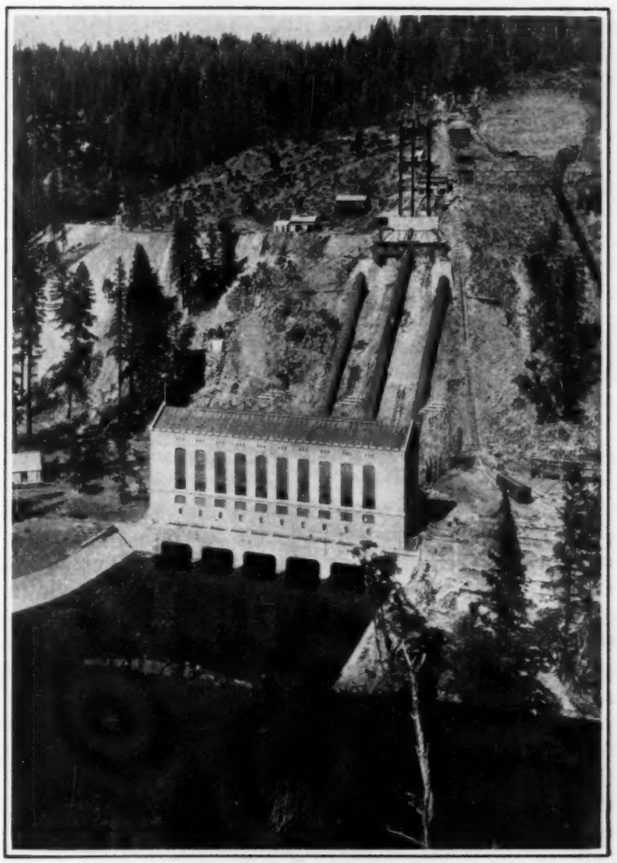


FIG. 7—PLANT AS COMPLETED

strictly to the draft tube outline as specified and to secure a smooth finish to the concrete. This calls for expensive form work, and a great deal of hand trimming is necessary to secure the smooth flow lines required. On this job considerable saving in construction cost was made and a better job secured by the use of steel draft tube liners. These liners were made of ⅜-in. steel plates, butt strap-riveted with countersunk rivets, on the side away from the water. When assembled in place, these liners acted as forms and only rough timber shoring was required to hold them in place and prevent deformation while concrete was being poured.

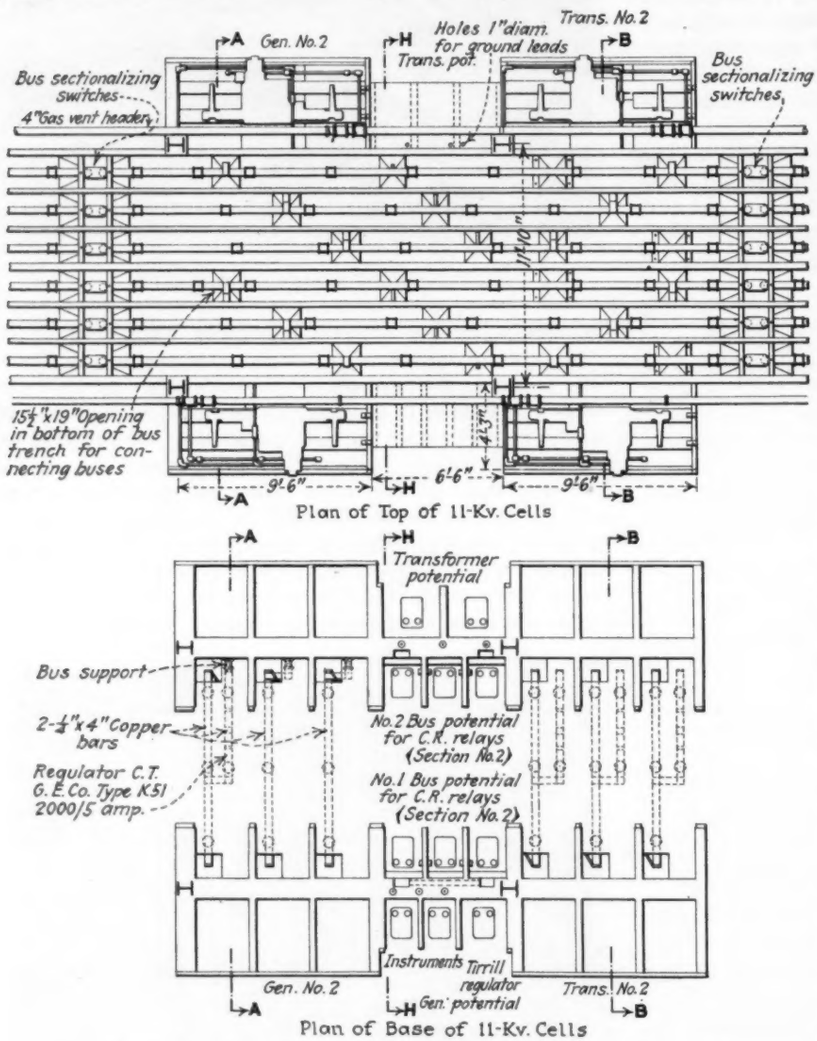


FIG. 8—PLAN OF 11,000-VOLT SWITCH AND BUS STRUCTURE

Measurement of water is accomplished by Venturi meters placed in each penstock. In order to obtain pressure differences for actuating the instruments, use is made of a section 7 ft. long in each penstock, wherein the diameter of the pipe is reduced from 10 ft. to 9 ft. These taper sections are located where the penstocks enter the penstock tunnels under the power house and afford a convenient means for securing pressure readings. The piezometer rings consist of brass pipes surrounding the penstock and connected to it at four points. One of these rings is installed near each end of the taper section. Acceptance tests on the turbines will be made by the brine velocity method and during these tests calibrations of the Venturi meters will be made.

The main generators were furnished by the General Electric Company and are rated at 27,000 kva. 90 per cent lagging power factor, three phase, 60 cycles, 11,000 volts, 225 r.p.m. The generator cooling air is discharged into a sheet-iron housing, from which it is exhausted through louvers in the tailrace wall of the building. Doors are provided in the air housing to permit discharging hot air into the building for recirculation during the cold winter weather. A steel rolling door is mounted inside the louvers and operated from the outside of the air housing to regulate the amount of opening, and consequently the proportion of air that is discharged outside the building and into the room through the doors in the housing. Inasmuch as no regulation of the incoming air can be had, the doors in the housing as well as the steel rolling doors inside the louvers are made automatic so that they will close from any position in case the generator differential relays operate. This serves to cut off all ventilating air and aids in smothering a fire should one be started. In addition, the generators are equipped with water piping so arranged as thoroughly to drench the windings in case of fire.

Each generator has a direct-connected 160-kw., 250-volt exciter mounted on top of the unit. Each exciter has capacity sufficient for one generator. In addition there is a spare exciter set consisting of a 160-kw., 250-volt, 225-r.p.m. generator, which may be driven by a 250-kw., 440-volt synchronous motor or by a Pelton impulse waterwheel. This unit, in addition to serving as a spare exciter set, may be driven from the waterwheel with the motor inverted to act as a 250-kw., 440-volt generator for emergency station power service.

Each direct-connected exciter is arranged for use only on the unit to which it is connected and the spare exciter may be substituted for any one of the three direct-connected exciters. There is no exciter switchboard, but a pair of double pole solenoid-operated field switches is located near each generator. These switches are electrically interlocked so that only one may be closed at a time, provision being made for bypassing the interlock to permit paralleling the spare exciter with the direct-connected exciter in order to transfer the load without taking field off the generator.

All six leads are brought out of each main generator in order to permit of differential relay protection. The leads of the low or grounded end of the windings pass through current transformers and are then solidly grounded through a disconnecting switch and two 500,000-circ.-mil coppet cables to the main station ground. The ground switch and current transformers are mounted in a recess in the generator pedestal. The high side of the winding is carried in varnished cambric insulated cables in fiber ducts to the 11,000-volt switch and bus structure.

There are three 27,000-kva. banks of main trans-

formers with one spare unit. The transformers were furnished by the Westinghouse Electric & Manufacturing Company and are rated 9,000 kva., 127,000 volts high voltage and 11,000 volts low voltage. They are oil-insulated, water-cooled, outdoor type transformers, star connected on the high side to give 220,000 volts between lines with the neutral point solidly grounded, and delta connected on the low-voltage side. The banks are located on the penstock side of the power house in a line parallel to the center line through the generators and conveniently situated with regard to the 11,000-volt bus structure. They are set on rails elevated 2 ft. above the rails of the transfer car track, and a turntable is provided to permit bringing the units into the power house for handling by the crane.

With the transformer banks of the same capacity as the generators, it would seem at first thought that the low-voltage transformer and generator switches might be eliminated entirely and the generators connected directly to the transformers. This is considered good practice where voltages lower than 220-kv. are employed on the outgoing lines. With the elimination of generator switches, it becomes necessary to synchronize on the high-voltage side of the transformers. There are two good reasons for not doing this at 220-kv. In the first place, the 220-kv. oil circuit breakers are of very large physical dimensions and due to the inertia of their moving parts they are relatively slow in closing. This makes synchronizing difficult. The second reason is the excessive cost of 220-kv. potential transformers.

Another reason for the use of a generator bus when transmitting power over long lines operating at 220-kv. is the large line charging currents involved. At certain loads, this leading kilovolt-amperage will necessitate a very weak generator field, which makes the generators hard to hold in step. By tying them together on the 11,000-volt side of the transformers, a better condition for operating is secured.

An extremely convenient arrangement of 11,000-volt bus and switches has been designed for this plant. This arrangement is shown in Figs. 2, 3, 4 and 8. General Electric Type H-209 oil circuit breakers with a special staggered pot arrangement are used. This permits a double back connected breaker without the extreme length of cell required by the tandem arrangement of pots. Disconnecting switches are so arranged that the entire oil switch is cleared from the bus at one point and the operator is assured that the switch is safe to touch. The switch cells are arranged in pairs with their associated potential transformers between and a passageway around either end of the group. This makes for safety to the operator, as it is impossible to confuse phases and open two legs of one circuit and one of another. The oil switches, all disconnecting switches and potential transformer fuses are on one floor, making for convenience in operation.

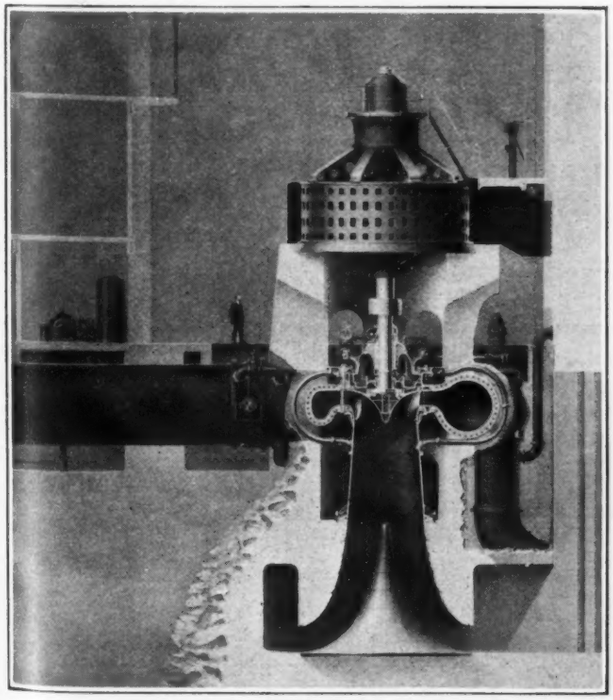


FIG. 9—PHOTOGRAPHIC CROSS-SECTION OF HYDRAULIC TURBINES INSTALLED IN PIT 3 POWER HOUSE

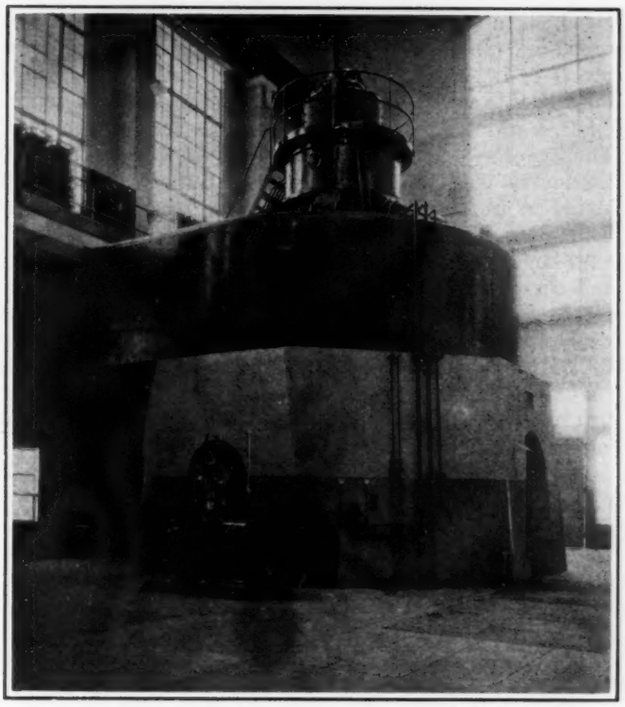


FIG. 10—ONE UNIT INSTALLED IN PLANT

The 220-kv. oil circuit breakers were furnished by the Westinghouse company and are not materially different except in physical dimensions from those that have been used on lower voltages. They are solenoid-operated, outdoor type, 400-amp. breakers.

The real problem in connection with 220-kv. switching is in the disconnecting switches. The same type of switch developed for the initial 220-kv. stations was again installed. (See Fig. 12.) These switches were built by the Pacific Electric Manufacturing Company under the supervision of the engineering department of the Pacific Gas & Electric Company and have met all requirements and proved adequate to meet the demands made upon them. They require a minimum of overhead space with no increased phase separation and permit a very convenient arrangement of disconnecting and bypass switches.

The main switchboard room is located on the third floor of the switch house and is centrally situated with regard to the main generating units. A glass-inclosed balcony affords the operator a clear view of the entire generator bay, and the windows in the penstock side of the room permit a commanding view of the main transformers and high-voltage switches. There is a

benchboard on which are located all control switches and hand reset auxiliary relays. Behind this benchboard is located the instrument and relay board, with instruments on the upper part of the board and relays on the lower part, all clearly visible to the operator. There are two auxiliary boards, one on either side of the instrument board and in line with it. The auxiliary board to the right of the main board is a dead front board for the control of all small motors and station auxiliaries. This is a steel front board, with all fuses and current-carrying parts shielded. Fuses may be replaced from the front of the board through small doors, which can be opened only when the circuit is dead. To the left of the main instrument board is the voltage regulator board, with an additional panel for the control of the station storage battery and two 7½-kw. battery-charging sets.

The so-called generator floor has been omitted in this plant, the generators being placed on pedestals. To afford the operator convenient access to the tops of the generators without the necessity of descending to the main turbine floor and climbing back to the top of the units, a walkway at the elevation of the switchboard balcony continues around one end of the generator bay. A flight of a few steps brings the operator to a lower balcony with floor at the elevation of the top of the generator stator frames. Located on this balcony, which is continuous between the three generators on the tailrace side of the power house, are the field switches and field rheostats, all remote controlled from the main switchboard, but clearly visible and accessible, and so located as to reduce the length of field leads to a minimum.

The operating force on duty consists of three men. The first operator is in charge of the plant and is stationed at the main switchboard. By means of the controls located on the benchboard he can make all switching operations, vary the load on a generator or start or stop a turbine. The second operator has no fixed station, but is responsible for observing bearing and transformer temperatures and the general condition of affairs throughout the plant. Under orders from the first operator, he operates all disconnecting switches and performs such other duties as may be required. The third operator is stationed on the turbine floor near the governors. It is his duty to open and close valves and prepare a turbine for starting by the first operator. The third operator is charged with the care of the turbines and is responsible for the proper lubrication of all moving parts and the operation of the governor oil-pumping sets, air compressor, etc.

The power house is equipped with two 75-ton electric traveling cranes with 440-volt, three-phase motors. The rotating elements of the generating units weigh approximately 130 tons, but it is seldom necessary to lift this entire load at one time. When such occasion arises, use is made of an equalizer beam, which permits the operation of both cranes. At other times a single 75-ton crane will handle all loads required. Careful estimates of cost have shown practically no difference as between two small cranes and a single large one, the latter requiring additional head room under roof trusses and heavier columns and crane girders, which just about offsets the increased cost of two cranes versus one.

Actual construction of the 4-mile tunnel was started Aug. 5, 1923, and ground was broken at both the dam and power house sites on Dec. 1, 1923. The

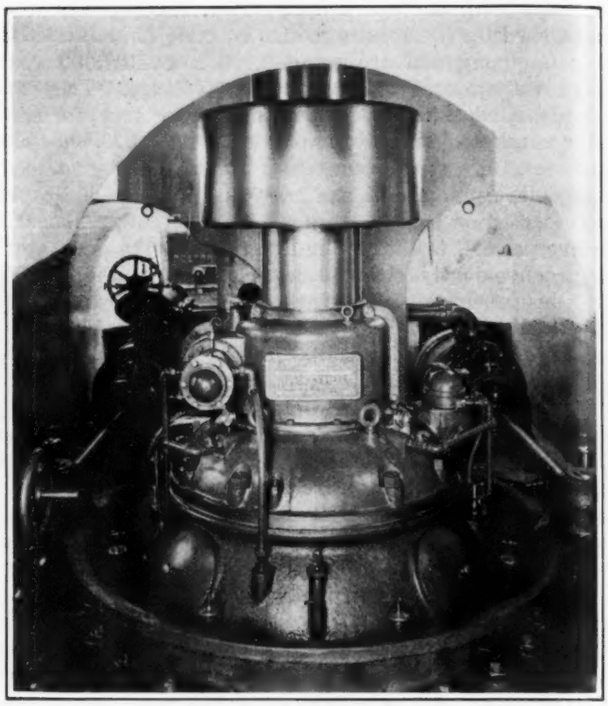


FIG. 11—WATER-WHEEL CONTROL MECHANISM

first concrete was poured in the power house on July 9, 1924, almost exactly one year prior to the date of starting the first unit. Construction progressed continuously and without delays, and several records, notably in connection with the tunnel boring, have been established. It is with considerable pride of achievement that the engineering and construction departments of the Pacific Gas & Electric Company turn over the latest development to the further advancement of "Pacific Service."

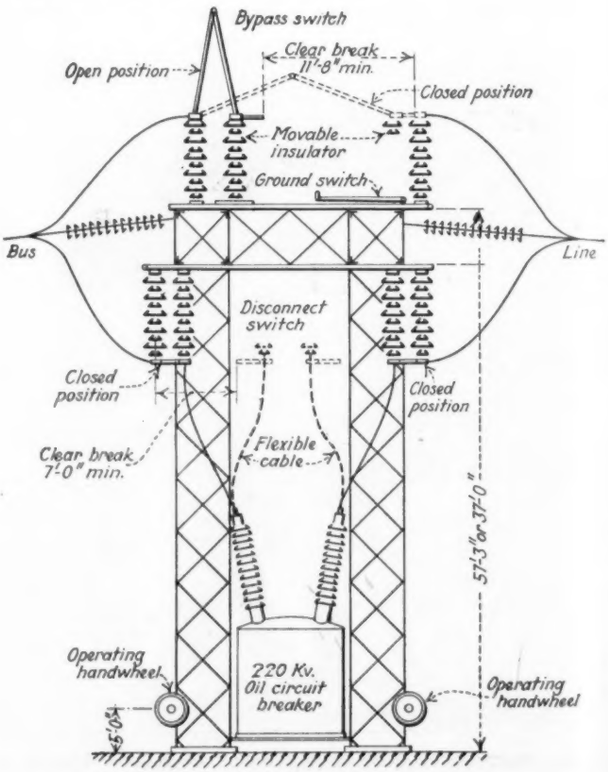
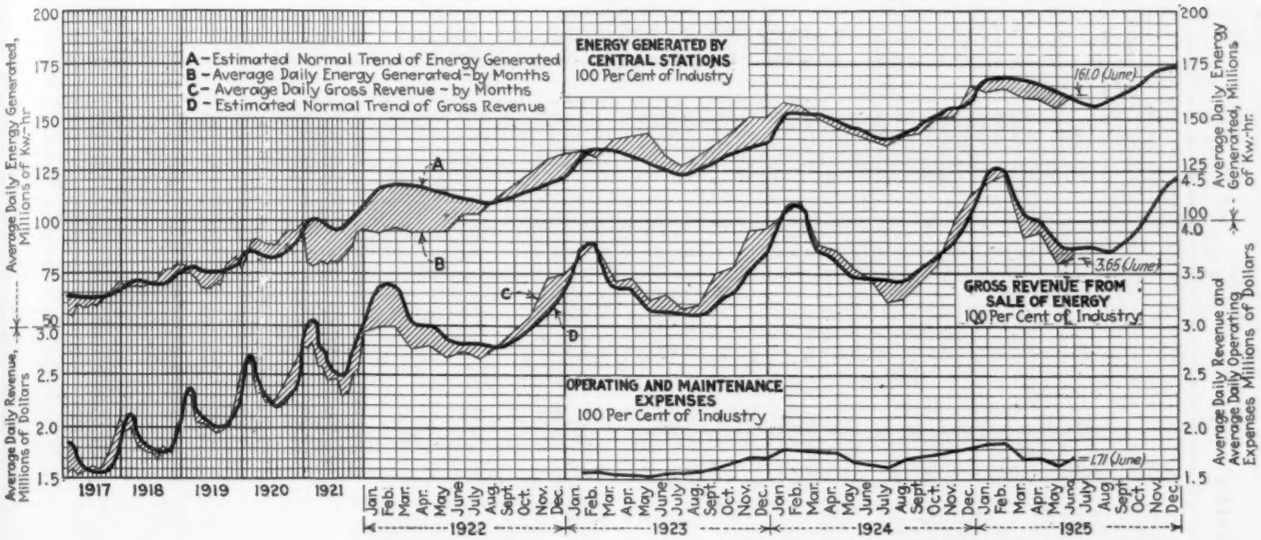


FIG. 12—ARRANGEMENT OF 220-KV. AIR BREAK SWITCHES


A – Estimated Normal Trend of Energy Generated
B – Average Daily Energy Generated – by Months
C – Average Daily Gross Revenue – by Months
D – Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
161.0 (June)
3.65 (June)
1.71 (June)
Average Daily Energy Generated, Millions of Kw.-hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses, Millions of Dollars
1917 1918 1919 1920 1921
1922 1923 1924 1925

Energy Requirements 8.4 per Cent Over Last Year

CENTRAL-STATION operations during the first half of 1924, as reported monthly to the ELECTRICAL WORLD, showed a gradual increase as the year developed, with a material gain recorded during June. In the country as a whole the amount of energy generated increased from 6.8 per cent above 1924 operations in January to 14.7 per cent above 1924 operations in June. The amount of energy generated during the six-month period—29,104,105,000 kw.-hr.—was 8.4 per cent above that generated during the same period last year. If this rate of increase is maintained during the last half of the year, the output of the industry for 1925 should total around fifty-nine billion kilowatt-hours.

During the six-month period a total of 5,620,000,000 kw.-hr. was used in intracompany business, including line losses. Some indication of the influence of interconnection on the operations of the industry is to be found in the fact that the amount of energy sold by the generating companies to other utilities for resale increased from 3,585,000,000 kw.-hr. in 1923 to 4,237,290,000 kw.-hr. in 1924 and to 4,531,500,000 kw.-hr. in 1925. This would indicate an increase of 26 per cent in intercompany operations during the two-year period.

During the present year the energy generated in hydro-electric plants should total almost twenty-five billion kilowatt hours and the steam plant generation thirty-four billion kilowatt hours. The operations of

TABLE I—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly *			Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business Including Line Losses, Kw.-Hr.			
	1925 Thousands	1924 Thousands	Per Cent Inc.	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands
January	5,121,776	4,792,704	6.8	4,133,776	3,867,704	1,168,000	1,118,000	2,429,776	2,225,704	536,000	524,000	988,000	925,000	760,000	712,000
February	4,598,454	4,465,858	3.0	3,710,454	3,604,858	1,044,000	1,000,000	2,181,454	2,114,858	485,000	490,000	888,000	861,000	745,500	663,000
March	4,963,857	4,595,960	8.1	4,008,857	3,707,960	1,123,000	1,075,000	2,349,857	2,108,960	536,000	524,000	958,000	888,000	768,000	704,000
April	4,777,289	4,351,120	9.8	3,854,289	3,511,120	1,067,000	1,022,000	2,278,289	2,006,120	509,000	483,000	923,000	792,000	768,000	732,800
May	4,812,567	4,412,082	9.1	3,883,567	3,560,582	1,077,000	1,032,000	2,266,567	1,996,582	540,000	532,000	929,000	822,500	763,000	732,500
June	4,830,162	4,220,184	14.7	3,896,162	3,406,684	1,067,000	1,021,000	2,307,162	1,902,684	522,200	483,000	934,000	803,500	727,000	692,990
Totals for six months	29,104,105	26,837,908	8.4	23,487,105	21,658,908	6,546,000	6,268,000	13,813,105	12,354,908	3,128,200	3,036,000	5,620,000	5,092,000	4,531,500	4,237,290

* Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only

TABLE II—CENTRAL-STATION FINANCIAL OPERATIONS FOR SIX MONTHS IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Gross Revenue from Sale of Energy†			Operating and Maintenance Expenses‡			Operating Ratio					
							Steam Plants		Hydro Plants		Combined Steam and Hydro Plants	
	1925 Thousands	1924 Thousands	Per Cent Increase	1925 Thousands	1924 Thousands	Per Cent Increase	1925	1924	1925	1924	1925	1924
January	$135,000	$120,800	11.7	$56,200	$52,200	7.6	45.3	47.0	26.0	24.6	43.4	43.0
February	124,800	116,500	7.2	51,800	50,700	2.4	42.9	45.7	30.9	27.1	40.3	44.0
March	119,000	112,300	5.9	52,400	51,100	2.7	43.0	46.0	30.0	28.0	39.0	42.0
April	116,800	108,300	7.9	52,100	48,600	7.2	44.0	49.2	29.0	29.0	40.5	46.8
May	111,400	101,200	10.2	51,200	47,700	7.3	49.1	50.4	23.7	32.8	44.2	46.9
June	109,400	100,300	9.2	51,300	47,500	8.2	52.1	52.1	28.8	25.4	43.4	46.0
Totals for six months	$716,400	$659,400	8.5	$315,000	$297,000	6.1	....	....	....	....	....	....

† Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡ Do not include interest, taxes, depreciation or sinking fund.

Developed and Potential Water Power in the United States

	Developed Water Power in the United States (Plants of 100-Hp. or More)											Potential Water Power Resources of the United States			
	Number of Plants, March 1, 1925			Capacity in Horsepower, March 1, 1925			Capacity in Horsepower, Jan. 1, 1924			Capacity in Horsepower, Jan. 1, 1921			Available 90 Per Cent of the Time		Available 50 Per Cent of the Time	
	Total	Public Utility and Municipal	Manufacturing and Miscellaneous	Total	Public Utility and Municipal	Manufacturing and Miscellaneous	Total	Public Utility and Municipal	Manufacturing and Miscellaneous	Total	Public Utility and Municipal	Manufacturing and Miscellaneous	Horsepower	Per Cent	Horsepower	Per Cent
United States	.....	...	...	10,037,655	8,287,332	1,750,323	9,086,938	7,348,197	1,738,761	7,926,958	6,200,380	1,726,578	34,818,000	100.00	55,030,000	100.00
New England	1,230	251	979	1,398,803	656,270	742,533	1,387,364	644,831	742,533	1,310,507	583,130	727,377	998,000	2.87	1,978,000	3.60
Middle Atlantic	611	402	209	1,948,449	1,624,316	324,133	1,731,881	1,408,173	323,708	1,478,904	1,167,539	311,365	4,317,000	12.40	5,688,000	10.35
East North Central	346	2	121	884,760	661,445	223,315	829,854	625,826	204,028	737,663	542,889	195,774	737,000	2.12	1,391,000	2.53
West North Central	194	127	67	514,753	414,692	100,061	459,736	376,864	82,872	444,396	360,625	83,771	871,000	2.50	1,844,000	3.35
South Atlantic	.....	...	...	1,589,304	1,352,478	236,826	1,295,978	1,045,728	250,250	1,076,909	799,767	277,142	2,476,000	7.11	4,464,000	8.11
East South Central	53	38	15	396,791	379,683	17,108	345,584	323,816	21,768	245,534	228,380	17,154	1,011,000	2.90	2,004,000	3.64
West South Central	29	14	15	31,317	27,105	4,212	16,727	12,515	4,212	16,274	12,515	3,759	434,000	1.25	888,000	1.61
Mountain	234	185	49	937,078	915,737	21,341	880,783	860,937	19,846	827,101	806,472	20,629	10,736,000	30.83	15,513,000	28.19
Pacific	299	244	55	2,336,400	2,255,606	80,794	2,139,051	2,049,507	89,544	1,788,670	1,699,063	89,607	13,238,000	38.02	21,260,000	38.63
New England																
Maine	252	74	178	476,627	174,662	301,965	473,188	171,223	301,965	449,614	156,549	293,065	536,000	1.54	1,074,000	1.95
New Hampshire	243	60	183	243,310	119,740	123,570	235,810	112,240	123,570	229,305	112,865	116,440	186,000	0.53	350,000	0.64
Vermont	206	60	146	167,816	114,701	53,115	167,816	114,701	53,115	129,566	72,651	56,915	80,000	0.23	169,000	0.31
Massachusetts	347	32	315	344,439	162,477	181,962	343,939	161,977	181,962	338,057	157,605	180,452	106,000	0.31	235,000	0.43
Rhode Island	59	5	54	30,188	3,285	26,903	30,188	3,285	26,903	30,136	3,510	26,626	25,000	0.07	40,000	0.07
Connecticut	123	20	103	136,423	81,405	55,018	136,423	81,405	55,018	133,829	79,950	53,879	65,000	0.19	110,000	0.20
Middle Atlantic																
New York	528	350	178	1,713,551	1,404,603	308,948	1,542,983	1,234,460	308,523	1,291,857	993,601	298,256	4,010,000	11.52	4,960,000	9.03
New Jersey	34	10	24	18,902	8,658	10,244	18,902	8,658	10,244	17,051	8,883	8,168	50,000	0.14	90,000	0.16
Pennsylvania	49	42	7	225,996	221,055	4,941	169,996	165,055	4,941	169,996	165,055	4,941	257,000	0.74	638,000	1.16
East North Central																
Ohio	25	17	8	29,570	24,486	5,084	29,753	24,486	5,267	28,663	24,236	4,427	55,000	0.16	166,000	0.30
Indiana	24	17	7	51,276	47,711	3,565	29,199	25,489	3,710	27,122	21,236	5,886	40,000	0.12	110,000	0.20
Illinois	30	15	15	86,679	69,759	16,920	85,002	73,591	11,411	85,002	73,591	11,411	189,000	0.54	361,000	0.66
Michigan	111	92	19	304,520	255,348	49,172	281,618	242,052	39,566	267,139	228,353	38,786	168,000	0.48	274,000	0.50
Wisconsin	156	84	72	412,715	264,141	148,574	404,282	260,208	144,074	330,737	195,473	125,264	285,000	0.82	480,000	0.87
West North Central																
Minnesota	62	40	22	262,786	185,664	77,122	211,850	151,917	59,933	205,180	145,247	59,933	203,000	0.58	401,000	0.73
Iowa	49	36	13	177,280	175,010	2,270	177,280	175,010	2,270	173,437	169,614	3,823	169,000	0.49	395,000	0.72
Missouri	7	5	2	19,970	19,670	300	17,970	17,670	300	17,970	17,670	300	67,000	0.19	152,000	0.27
North Dakota	1	0	1	245	0	245	245	0	245	245	0	245	82,000	0.23	193,000	0.35
South Dakota	9	5	4	19,171	7,050	12,121	18,171	6,050	12,121	18,227	6,050	12,177	63,000	0.18	110,000	0.20
Nebraska	45	30	15	20,837	17,437	3,400	19,716	16,316	3,400	14,726	12,036	2,690	183,000	0.53	342,000	0.62
Kansas	21	11	10	14,464	9,861	4,603	14,504	9,901	4,603	14,611	10,008	4,603	104,000	0.30	251,000	0.46
South Atlantic																
Delaware	9	0	9	3,133	0	3,133	3,133	0	3,133	3,133	0	3,133	5,000	0.01	10,000	0.02
Maryland	19	6	13	7,230	2,120	5,110	7,230	2,120	5,110	7,230	2,120	5,110	*106,000	*0.30	*238,000	*0.43
District of Columbia	4	0	4	666	0	666	666	0	666	666	0	666	.....	.....	.....	.....
Virginia	70	34	36	117,869	90,727	27,142	109,798	82,656	27,142	103,693	76,551	27,142	459,000	1.32	812,000	1.48
West Virginia	11	6	5	14,711	8,446	6,265	14,711	8,446	6,265	14,675	8,410	6,265	355,000	1.02	980,000	1.78
North Carolina	.....	...	...	534,600	379,600	155,000	431,500	246,400	185,100	329,853	126,205	203,648	540,000	1.55	816,000	1.48
South Carolina	.....	...	...	507,215	482,215	25,000	357,510	348,750	8,760	330,012	321,250	8,762	429,000	1.23	632,000	1.15
Georgia	53	35	18	394,794	380,720	14,074	364,394	350,320	14,074	281,111	262,495	18,616	572,000	1.65	958,000	1.74
Florida	5	3	2	9,086	8,650	436	7,036	7,036	0	6,536	2,736	3,800	10,000	0.03	18,000	0.03
East South Central																
Kentucky	5	2	3	1,256	352	904	1,256	352	904	855	115	740	77,000	0.22	184,000	0.33
Tennessee	27	21	6	166,347	165,381	966	128,465	127,439	1,026	126,891	125,865	1,026	432,000	1.24	710,000	1.29
Alabama	21	15	6	229,188	213,950	15,238	215,863	196,025	19,838	117,788	102,400	15,388	472,000	1.35	1,050,000	1.91
Mississippi	0	0	0	0	0	0	0	0	0	0	0	0	30,000	0.09	60,000	0.11
West South Central																
Arkansas	4	3	1	15,549	15,080	469	1,189	720	469	1,189	720	469	125,000	0.36	178,000	0.32
Louisiana	0	0	0	0	0	0	0	0	0	0	0	0	1,000	0.00	2,000	0.00
Oklahoma	4	4	0	1,948	1,948	0	1,718	1,718	0	1,718	1,718	0	70,000	0.20	194,000	0.35
Texas	21	7	14	13,820	10,077	3,743	13,820	10,077	3,743	13,367	10,077	3,290	238,000	0.69	514,000	0.94
Mountain																
Montana	30	28	2	360,040	358,100	1,940	345,040	343,100	1,940	344,420	342,480	1,940	2,550,000	7.32	3,700,000	6.72
Idaho	48	44	4	298,837	297,887	950	270,918	269,021	1,897	224,368	222,471	1,897	2,122,000	6.10	4,032,000	7.33
Wyoming	10	9	1	7,886	7,560	326	7,886	7,560	326	7,560	7,560	0	704,000	2.02	1,182,000	2.15
Colorado	56	30	26	90,536	77,696	12,840	87,978	77,880	10,098	91,648	79,708	11,940	765,000	2.20	1,570,000	2.85
New Mexico	6	6	0	1,455	1,455	0	1,322	1,322	0	799	799	0	116,000	0.33	186,000	0.34
Arizona	8	8	0	49,360	49,360	0	38,760	38,760	0	38,760	38,760	0	2,759,000	7.92	2,887,000	5.25
Utah	66	51	15	115,329	110,344	4,985	115,329	110,344	4,985	106,096	101,844	4,252	1,420,000	4.08	1,586,000	2.88
Nevada	10	9	1	13,635	13,335	300	13,550	12,950	600	13,450	12,850	600	300,000	0.86	370,000	0.67
Pacific																
Washington	72	66	6	560,693	549,746	10,947	480,356	469,139	11,217	454,356	443,139	11,217	4,970,000	14.27	7,871,000	14.30
Oregon	79	57	22	244,227	193,462	50,765	206,865	147,620	59,245	185,215	125,970	59,245	3,665,000	10.53	6,715,000	12.20
California	148	121	27	1,531,480	1,512,398	19,082	1,451,830	1,432,748	19,082	1,149,099	1,129,954	19,145	4,603,000	13.22	6,674,000	12.13

* Maryland and District of Columbia.

TABLE III—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL POWER PLANTS IN THE UNITED STATES ||
(100 per Cent of the Industry)

Month	Energy Generated						Fuel Consumption								
	Hydro Plants			Fuel Power Plants			Coal			Oil			Gas		
	1925 Thousands of Kw.-Hr.	1924 Thousands of Kw.-Hr.	Per Cent Inc.	1925 Thousands of Kw.-Hr.	1924 Thousands of Kw.-Hr.	Per Cent Inc.	1925 Short Tons	1924 Short Tons	Per Cent Inc.	1925 Barrels	1924 Barrels	Per Cent Inc.	1925 Thousands of Cu. Ft.	1924 Thousands of Cu. Ft.	Per Cent Inc.
January	1,676,536	.....	....	3,445,240	.....	....	3,230,153	.....	....	1,329,855	.....	.....	2,898,225	.....	....
February	1,718,459	.....	....	2,879,995	.....	....	2,719,427	.....	....	954,556	.....	.....	2,457,897	.....	....
March	2,009,222	1,705,060	17.4	2,954,635	2,890,000	2.4	2,754,265	2,781,084	—1.0	791,496	1,496,604	—46.2	3,214,656	3,099,404	3.9
April	1,988,621	1,822,448	9.2	2,788,608	2,528,672	10.3	2,587,289	2,470,245	4.8	658,080	1,186,779	—44.3	3,367,663	2,731,201	23.4
May	1,992,096	1,915,001	4.1	2,820,471	2,497,081	13.0	2,580,342	2,405,151	7.3	639,702	1,161,270	—44.9	3,438,604	2,908,367	18.3
June	1,814,412	1,730,796	4.9	3,015,750	2,889,388	4.4	2,716,426	2,316,371	17.2	738,374	1,264,211	—41.7	3,550,898	3,623,144	—2.2
Totals for six months	11,199,346	.....	....	17,904,759	.....	....	16,587,902	.....	....	5,112,063	.....	.....	18,927,943	.....	.....

|| As collected by United States Geological Survey. The data are for the electric light and power industry only.

the two types of plants during June showed an increase over last year of 4.9 per cent for the hydro plants and 4.4 per cent for the steam plants. During the first half of the year 38.4 per cent of the total energy was generated in hydro plants and 61.6 per cent in steam plants.

The indications are that the energy lost in transmission or used in intra-company business from which there is no revenue will reach almost twelve billion kilowatt hours during the year. This is more than the total amount of energy generated by the industry in 1912, indicating the wonderful strides made by the industry during the thirteen-year period.

A very noticeable decrease in the use of fuel oil was reported in the six-month period. Reports for only four months of 1924 are available but during these same months in 1925 over 40 per cent less fuel oil was consumed than was reported for last year. On the other hand a large increase in gas consumption was reported for April and May, and a 17.2 per cent increase in coal consumption during June. The indications are that the consumption of coal by the utilities of the country will run over forty million tons during 1925, which would be a record figure.

Expressing the financial phase of the returns in terms of the operating ratio, or ratio of operating expenses to the gross revenue from the sale of energy, shows that financially the industry is very close to the position it occupied this time last year. The operating ratio reported for June by companies having steam plants only, taken in the aggregate, was 52.1 per cent which was also the operating ratio reported by this class of operating companies in June of last year. The operating ratio of these companies increased from 45.3 per cent in January to 52.1 per cent in June, but this increase is normal resulting entirely from the seasonal decrease in the proportional amount of high-revenue residential load. A study of past history indicates that the operating ratio should show a decrease in July.

A very noticeable increase in the amount of energy consumed for power purposes is indicated for the six-month period, almost one and a half billion kilowatt-hours more energy being consumed this year than last. The lighting load was increased by 4.5 per cent and the electric railway load by 3.2 per cent.

The gross revenue during the six-month period totaled $716,400,000 and the operating expenses totaled $315,000,000. A detailed discussion of the financial operations of the industry will be found in the "Financial and Corporate" section of this issue. The net amount of energy sold to all customers totaled 23,487,105,000 kw.-hr. during the six-month period.

Hydro Development in 1924

Total of 951,000 Hp. Added to the Previous Figures, Bringing the Nation's Developed Water Power to More Than 10,000,000 Hp.

THE Department of the Interior, through the Geological Survey, has just released a report on the developed water power of the United States in 1925. The report shows that the total capacity of water-wheels installed in plants of 100 hp. or more in March, 1925, was about 10,038,000 hp., an increase of about 951,000 hp., or nearly 10½ per cent, over the total capacity of water-power plants in 1924 (9,087,000 hp.). Of this increase 99 per cent was in electric public utility plants and 1 per cent in manufacturing plants.

New York continues to lead the rest of the states in the amount of developed water power. The five leading water-power states in order of their rank and the amount of developed water power for each are as follows: New York, 1,713,551 hp.; California, 1,531,480 hp.; Washington, 560,693 hp.; North Carolina, 534,600 hp.; Maine, 476,627 hp. North Carolina has moved from fifth place in 1924 to fourth place in 1925.

The report indicates that water-power development in the Middle Atlantic, South Atlantic and East South Central States is progressing more rapidly than in any other section of the country. New England's relative standing continues to decrease. Development in the Pacific States during 1924 failed to keep up with the rate maintained by the rest of the United States.

The report also contains records of the developed water power for 1924 and 1921 and the estimates of potential water power for 90 per cent and 50 per cent of the time computed in 1924. Based on present practice at fully developed water-power sites, the undeveloped water power in the five states leading in developed water power will permit of the installation of the following additional capacities in waterwheels, expressed in horsepower: New York, 4,734,000; California, 7,145,000; Washington, 9,672,000; North Carolina, 526,000; Maine, 920,000.

Studies of the installed capacity at fully developed water-power sites indicate that in general the ultimate capacity of water wheels that may be installed at any power site will average about 130 per cent of the potential power available 50 per cent of the time. Therefore to determine the capacity of the water wheels that may ultimately be installed in water-power plants in any State the capacity of water wheels already installed should be subtracted from 130 per cent of the power available 50 per cent of the time as shown in the table on page 462.

Distribution of Canadian Niagara Power

System Peak Now 495,000 Kilowatts—Annual Load Factor 78 per Cent—Major Transmission System Uses 110,000-Volt Lines

POWER from Niagara Falls as generated on the Canadian side under the authority of the Hydro-Electric Power Commission of Ontario is disposed of in many ways and distributed at several voltages to many localities. The system peak based on one minute reached 495,000 kw. in December, 1924, and January, 1925, and the following summer peak in June and July was about 400,000 kw. The system annual load factor under these conditions was about 78.

Many conditions, such as long-time contracts, historical developments in successive stages of the art and distance and types of loads, have influenced the growth of the system to the present status. All the energy generated is at 25 cycles but it is transmitted at 12, 30, 46, 60 and 110 kv. to the various localities and loads. The major transmission system is at 110 kv. for supplying the territory and towns of Ontario from Windsor east to Toronto. This system had a peak load of 270,000 kw. in December, 1924, and a summer valley of 210,000 kw. in June and July with an annual load factor of about 73. The other transmission systems are to supply power contracts of constant magnitude or to loads that have a load factor of nearly 100 per cent.

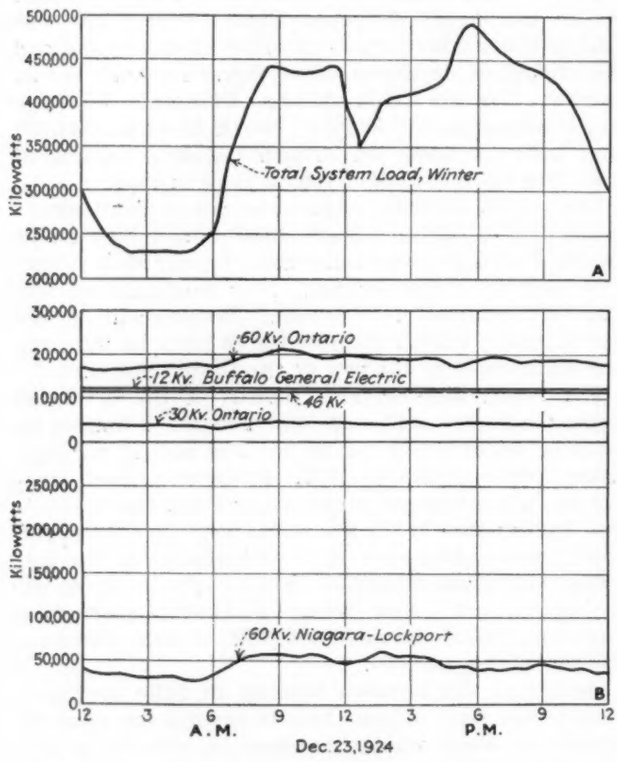


FIG. 1—WINTER LOAD ON CANADIAN GENERATING PLANTS AT NIAGARA FALLS

A. Total Hydro-Electric Power Commission of Ontario load on Niagara plants for Dec. 23, 1924. Peak load (one minute), 494,300-kw. Load factor, 75.6 per cent.

B. Distribution of Hydro Niagara power classified by transmission voltage. Dec. 23, 1924, 110-kv. system (general light and power in Ontario), load factor, 66.5; 60-kv. System (Niagara Lockport line); load factor, 71.8; 60-kv. system (Ontario), load factor, 100.00; 46-kv. system (Ontario), load factor, 97.2; 30-kv. system (Ontario), load factor, 90.7; 12-kv. system (Buffalo General Electric Company), load factor, 97.1.

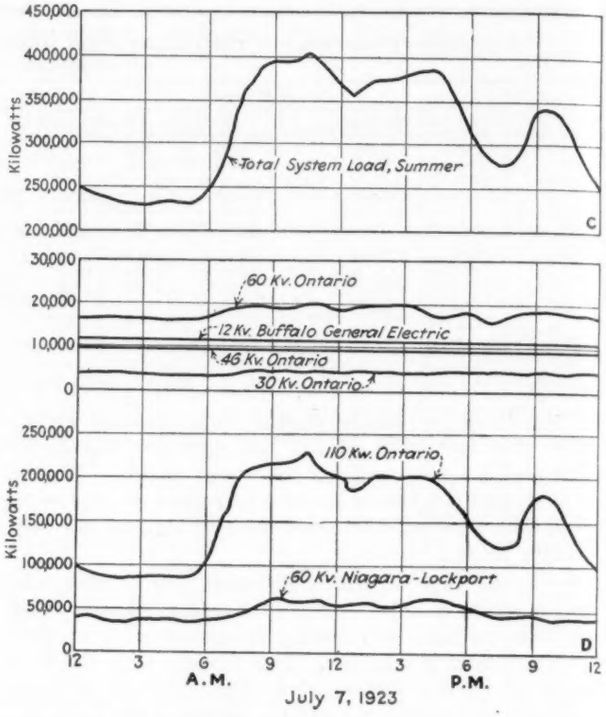


FIG. 2—SUMMER LOAD ON CANADIAN PLANTS AT NIAGARA FALLS

C. Total system load of Hydro-Electric Power Commission at Niagara stations for July 7, 1925. Peak (one minute), 405,500-kw. Load factor, 78.4 per cent.

D. Distribution of power from Canadian Niagara plants classified by transmission voltages. July 7, 1925: 110-kv. system (general light and power in Ontario), load factor, 68.4; 60-kv. system (Niagara Lockport line), load factor, 70.0; 60-kv. system (Ontario), load factor, 85.2; 46-kv. system (Ontario), load factor, 96.4; 30-kv. system (Ontario), load factor, 76.6; 12-kv. system (Buffalo General Electric Company), load factor 96.4.

The accompanying curves are interesting as showing the characteristics of the system of the Hydro-Electric Power Commission as it pertains to Niagara power generation and distribution.

The total winter load curve of a typical day is shown in Fig. 1*A* and indicates a system peak of 494,300 kw. and a load factor of 75.6. In Fig. 1*B* for the same day the total system load is shown in units as determined by transmission voltage. A practically constant load is indicated for all transmission systems excepting the 110-kv. system. It is natural to expect a lower load factor on this system because of the types of loads supplied, but the load factor of 66.5 per cent is remarkably good for a system having a very large number of small towns, rural communities and large residential cities connected to the lines.

Similar curves for a typical summer day are shown in Figs. 2*C* and 2*B*. The winter peak is reduced to a summer peak load of 405,500 kw., but the load factor has increased to 78.4 as shown on Fig. 2*C*. In Fig. 2*D* the practically constant load conditions for all transmission excepting the 110-kv. is indicated and it will be noted that the 110-kva. system load factor has increased to 68.4.

The 110-kv. system has Toronto and Hamilton as large cities in the eastern part of the province and Windsor and many small cities in the west. Along the lake shores there is a fine vineyard, fruit and farming country with many hamlets and farms which are supplied through overhead and underground rural lines from the 110-kv. system transformer stations. This diversity and arrangement of load aids greatly in giving a good load factor on the 110-kv. system.

Letters from Our Readers

One Way to Reduce Trouble from Wrong Use of Fuses

To the Editor of the ELECTRICAL WORLD:

As this seems to be a day of "safety first," I have been considering a method of fusing lighting circuits that would help to prevent some of the trouble that is now constantly met. If the laymen could not purchase from the five and ten cent stores as well as from department stores 30-amp. fuses to be placed in 10-amp. circuits, I believe that would be the first step toward this particular "safety first."

My idea would be to discontinue the manufacture of all plug fuses above 15 amp. A 30-amp. cartridge fuse would then be used in all main lighting lines, for heaters and in other circuits requiring more than 15 amp. That would leave the 15-amp. plug fuse for lighting circuits only. W. E. NANCE.

Redlands, Cal.

Power Factor and Its Correction

To the Editor of the ELECTRICAL WORLD:

The article by E. N. Dittenhofer in the August 22 issue of the ELECTRICAL WORLD is very comprehensive and the data are valuable. In the first paragraph on page 367 it is stated that "It was found that the load was overmotored," etc., and that "the six 15-hp. motors were replaced by two 10-hp., 1,200-r.p.m. and four 7½-hp., 1,200-r.p.m. motors, making a reduction of 40 hp. in connected horsepower on this portion of the load." This was the obvious thing to do originally. It is poor policy to purchase motors too big for their jobs and then pay out an additional sum to correct the power factors of the more expensive and underloaded motors to what they would have been if smaller and less expensive motors had been installed in the first place. Even the 1½-hp. motors would have had fairly good power factors had it been possible to keep them fully loaded.

So much has been said against the induction motor as being the principal cause of low power factor, with its resulting serious economic consequences, that one might almost think this motor an inferior machine instead of the highly perfected and simple piece of apparatus that it really is. In many cases, trouble is not so much with the motors as with the men who install them. A good 7½-hp., 1,200-r.p.m. motor may have a power factor of 71 per cent at one-half rated load and 86 per cent at full rated load. Yet induction motors are almost invariably found underloaded. The induction motor has inherent power-factor-improving characteristics which make the individual power factor increase with the load. Of course, where duty cycles are such that the loads are reduced for certain periods, other means must be employed to maintain the average power factor. But motors can be overloaded during certain portions of the duty cycle and run underloaded during the other portions. The average is what counts, provided the slip is taken into consideration. So-called power-factor-corrective apparatus does not improve the power factors of the motors, but improves the power factors of the motors and corrective apparatus in combination. I favor the individual static condenser in certain cases for this reason.

I should like to see more such articles and also a defence of the extensive use of fractional-horsepower motors of low power factor and low efficiency in relatively large industrial plants. In such cases power-factor-corrective apparatus should be installed for economical operation. The plant distribution system is so linked up with the power-factor situation that it should always be investigated. In a great many cases the annual I^2R loss is sufficient to buy a new set of wires and cables each year, but this does not include labor and other materials. CHARLES R. UNDERHILL,
Consulting Electrical Engineer.

Waterbury, Conn.

Water Power or Mineral Oil in Georgia?

To the Editor of the ELECTRICAL WORLD:

If great opportunities exist anywhere in soviet Russia for electrification by the development of water power, it certainly is in the mountain districts of Transcaucasia, where the falls are of great height and even in the summer do not diminish to any large extent

The first impulse for the erection of a hydro-electric power station on the Kura River was given by the discovery of extensive coal and manganese ore deposits. The Kura power station, near Semo Aftschala, about 60 miles from the city of Tiflis, has a capacity of 36,000 hp. It was first thought that the cost of construction of this plant would not exceed 3,000,000 rubles ($1,550,000), but up to the present time the plant has devoured 15,000,000 rubles ($7,750,000). Whether it will ever be a paying institution is a question. Siemens engineers have now been called to the spot.

The manganese ores mined near Tschiatury are being shipped by the port of Poti as raw material. They are worked up in the blast furnaces of Rhenish Westphalia, Alsace-Lorraine or England. The Georgians have, of course, long since discovered that they are losing a good deal of profit by shipping the ores just as they come out of the pits, and they now are trying to keep these profits at home.

The Georgian soviet government has appointed a "ferromanganese commission" to study ways and means and especially the development of water power. This commission has advised the government to exploit first the waters of the Rion and Skoniska Skali Rivers and to erect on the banks of these rivers twenty-two power stations of a total ultimate capacity of 200,000 hp. At the head of the technical body which is to work out details of this project is Professor Ludins of the Technical High School of Charlottenburg, Germany, who has established an office at Tiflis. However, without foreign capital all this work will be in vain. The erection of the above-mentioned Kura plant is a burden for the Georgian government and acts as a check on new projects.

In case the Georgian electrification enterprises were developed step by step and in conformity with the economic requirements of the country, the oil pipe line from Baku to Batoum would be a splendid basis for the undertaking. HENRY L. GEISSEL.

Thoune, Switzerland.

The Compensated Asynchronous Motor in Europe

In the letter of Fr. Kade printed in the July 18 issue of the ELECTRICAL WORLD, on page 120, the statement is made in the first sentence in the second column that "First of all, the compensated asynchronous motor made its appearance." "Asynchronous" in this sentence is a misprint for "synchronous."

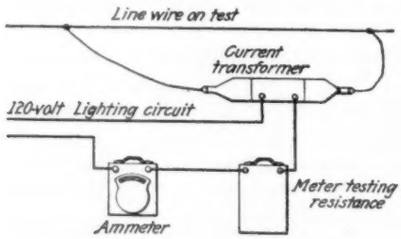
Central Station and Industrial Practice

Tests for Melting Sleet on Transmission Lines

By L. W. Wyss
Peninsular Power Company, Iron Mountain, Mich.

In order to be able to load lines to prevent the accumulation of sleet or to thaw it off after it has gathered tests can be conducted very easily with short spans of line conductors to enable intelligent operating procedure during sleet weather. The time taken for these tests is very cheap insurance when consideration is given to the fact that lines are often wrecked by sleet.

SHEET LENGTHS OF WIRE COVERED WITH ARTIFICIAL SLEET FOR TESTS



CONNECTION OF APPARATUS FOR COLLECTING SLEET THAWING DATA

One illustration shows four short spans of line wire that were loaded with spray when the temperature was 23 deg. F., while the other shows the simple method of connecting apparatus to build up the desired current in the wire. The length of time to clear the artificial sleet from the wires is given in the table.

The current values given were selected for these tests because generators on this system could be connected directly to high-tension lines of identical wire sizes and deliver the same current values used in the phantom load tests. The line would have to be removed from service and short-circuited at the other end.

Tests were also conducted during actual sleet weather and it was found that the sleet would not form on No. 3 copper or No. 0 aluminum when 100 amp. to 120 amp. was flowing.

DATA COLLECTED FROM SLEET MILLING TESTS

Temperature, Deg. F.	Wire Size	Material	Current, Amp.	Time Taken to Clear Lines, Minutes
23	No. 0	Copper	300	20
23	No. 2	Copper	280	10
23	No. 3	Copper	250	10
23	No. 0	Aluminum	225	20

This information can be used to load lines with actual load on some sections of this system if ever found necessary during sleet weather. Damaging sleet has rarely visited the upper peninsula of Michigan but the importance of maintaining service to iron mines that depend upon electric power for pumping warrants being prepared to fight it whenever it may become necessary.

Transformer Substations in Australia

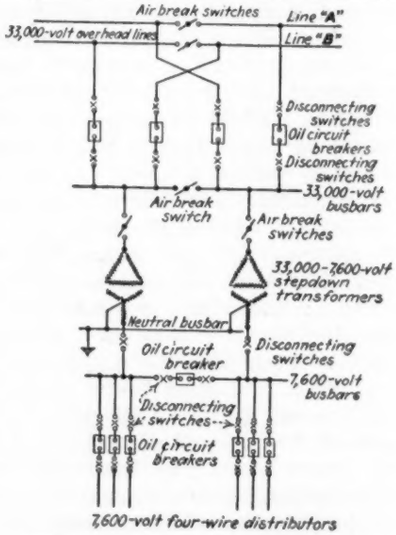
By F. W. H. Wheadon
Engineer and Manager, Adelaide Electric Supply Company, Ltd., Adelaide, Australia

All main transformer substations of the Adelaide Electric Supply Company are of the outdoor type, built on a space about 150 ft. x 100 ft. Control panels only are protected, these being inclosed in weatherproof cabinets placed near the switch structure. The busbar supporting framework is of 2-in. galvanized pipe, held together by standardized clamps, no screws or pipe fittings being used. The 2-in. pipe was imported in the required lengths, so that cutting and screwing were reduced to a minimum. The uprights are set in concrete pedestals consisting of 6-in. reinforced concrete pipe set 2 ft. in the ground in concrete.

For the 7,600-volt switches a 15,000-volt outdoor type is used, having a rupturing capacity of 4,200 amp. at 7,600 volts. These switches are bolted to the pipe framework. The trip coils in these are shunted by small fuses to obtain the necessary correct time delay, and are operated from bushing type current transformers. The 33,000-volt oil switches are of the same type and size as at the Osborne station. Their current rating is 400 amp., and they have a guaranteed rupturing capacity of 4,200 amp. at rated voltage. They have contacts of the tubular type surrounded by explosion chambers. At Osborne and East Terrace such switches are electrically operated by solenoid mechanism, but elsewhere they are manually operated.

In the manually operated stations a 30-volt primary battery is provided for tripping purposes. In order to keep the cells in good order it was found necessary to put a 3,000-ohm leak across the battery. The elements have a life of 500 amp.-hr., and are expected to have a life of four to five years under our conditions.

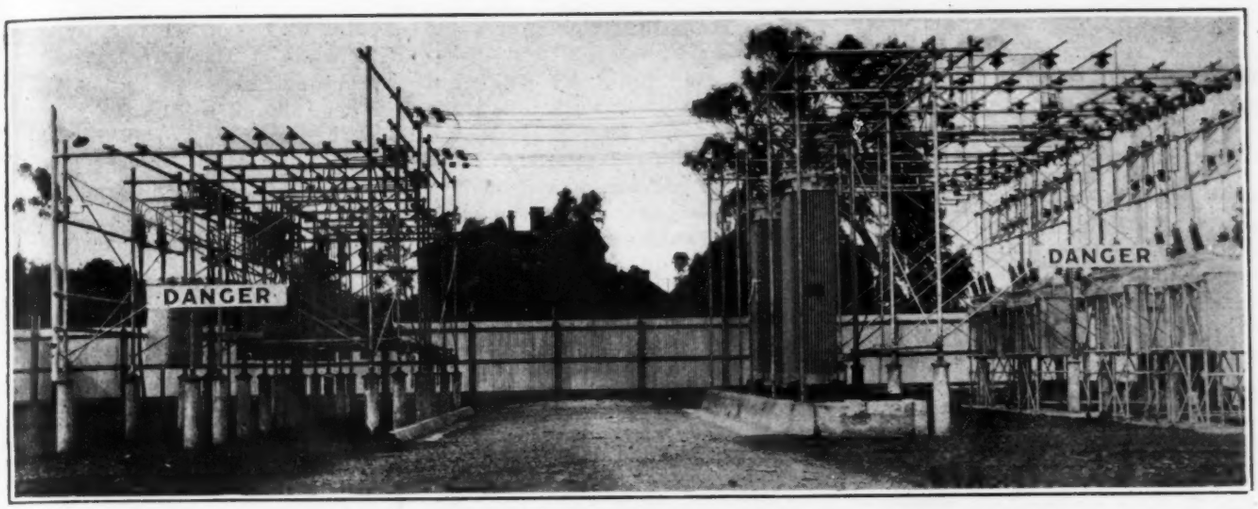
The 33,000-volt disconnecting switches and busbars are supported on pin insulators, having a flashover



TYPICAL SINGLE LINE DIAGRAM OF AUSTRALIAN SUBSTATION

voltage of not less than 145,000 volts dry and 90,000 volts wet. The busbars are of 1¼-in. and the connections are of ¾-in. solid drawn copper tubing. The busbars are divided into two sections on both 33,000-volt and 7,600-volt sides by bus section air-break switches.

The transformers used in these



NORWOOD 33,000/7,600-VOLT TRANSFORMER STATION IN AUSTRALIA

main substations are connected 33,000 volts delta to 7,600 volts star, the star point being solidly earthed. They are of the oil-insulated, self-cooled type, each weighing, complete with oil, eight tons. They are placed on concrete foundations 18 in. high. Sufficient space and clearance have been made in each main substation for four 1,200-kva. three-phase units, but those at present in use are 600 kva. three-phase. A special twelve-ton motor truck is used for moving the substation transformers, the truck being towed behind a 6-ton motor lorry, and a speed of eight miles per hour is maintained on good level roads.

The 33,000-volt portion of each transformer substation is divided from the 7,600-volt portion by a roadway of ample width to allow the transformer transporter and its motor lorry to be driven through and brought to rest with the transformer opposite its allotted position on the foundations. By means of a short length of steel rail connecting the transporter with the foundation, the transformer is easily wheeled into position.

In addition to the automatic sectionalizing of the substation (33,000-volt and 7,600-volt buses) provision has been made for entirely cutting out each of them from the ring by hand operated air break switches mounted on the transmission line towers outside the substation. In this way the Croydon substation, which is the most important junction on the system, can be completely disconnected, if necessary, without disturbing the supply to the other transformer substations on the transmission ring, with the consequent interruption to service.

Power-Factor Correction With Synchronous Motors

BY N. J. REED
Milwaukee, Wis.

FOR convenience in the determination of the corrective effect of synchronous motors on power factor the three formulas given below used in connection with the illustration will eliminate any trigonometric calculations. The curve represents the variation of the wattless component with the power factor. For the purpose of calculation, 100 kw. is adopted as the energy load. Call this wattless component "unit wattless." The symbols used in the three formulas are:

L_i = original kilowatt load on line.
L_c = load in kilowatts carried by synchronous motor =

$$\frac{Hp \times 0.746}{\text{Efficiency}}$$

$L = L_i + L_c$.
W_u = unit wattless.

Case 1. Installation of synchronous motor operating at 100 per cent power factor.

$$W_u \text{ at power factor of } L = \frac{L_i \times W_u \text{ at power factor of } L_i}{L}$$

Assume that the power factor of L_i is 70 per cent, the original load as 750 kw. and the synchronous motor load is 150 kw.

$$W_u \text{ at power factor of } L = \frac{750 \times 101.8}{900} = 84.8$$

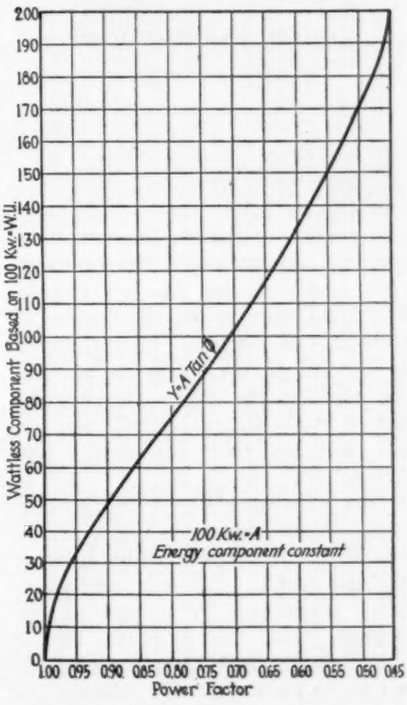
Referring to the curve, we find that for $W_u = 84.8$ the final power factor is 76 per cent.

Case 2. To correct to a given power factor by addition of a synchronous condenser.

W_u (unit corrective effort gained) = W_u (at initial power factor) — W_u (at required power factor).

Capacity of motor in kilovolt amperes = $\frac{L_i}{100} \times W_u$ (required).

Assume initial power factor of 70 per cent and required power factor of 80 per cent. From the curve, W_u



CURVE FOR POWER-FACTOR CORRECTION

at the initial power factor will be 101.8, while at the required power factor it will be 75.0. Then

W_u (unit corrective required) = 101.8 — 75 = 26.8 and

$$\text{Capacity of motor} = \frac{750}{100} \times 26.8 = 201 \text{ kva.}$$

Case 3. To correct to a given power factor by addition of a synchronous motor that is also required to carry a mechanical load.

$$W_u = \frac{L_l \times W_{u_1} - LW_{u_2}}{L_c}$$ where W_{u_1} is at initial power factor and W_{u_2} is at required power factor.

From the curve, the power factor corresponding to W_u is the leading power factor required of the synchronous motor. The capacity of the synchronous motor in kilovolt-amperes will then be =

$$\frac{L_c}{\text{Power factor of } L_c}$$

Make the same assumptions as in case 2. The synchronous motor is to have a load of 150 kw. Then

$$W_u = \frac{750 \times 101.8 - 900 \times 75}{150} = 58.7$$

The power factor corresponding to this value of W_u is 86 per cent. The capacity of the synchronous motor required in kilovolt-amperes will be

$$\frac{150}{0.86} = 174.5 \text{ kva.}$$

Electric Heat Used for Battery Compound

BY F. W. MCGRAW
Union Switch & Signal Company, Swissvale, Pa.

THE problem of heating battery compounds most effectively was found to be quite difficult. The specific gravity of the tar-like substance does not change with the temperature, which means that no circulation takes place when the bottom of a tankful is heated. Unlike water, the hot compound at the bottom does not rise to the top. Overheating causes carbonizing, which renders the compound unfit for sealing batteries.

This substance has a low specific heat, which means that it will not flow through tubes readily, because it chills easily. Since it was absolutely necessary, by nature of the process, that the mixture should flow through tubes, another obstacle had to be overcome. In addition to these difficulties, the mixture when heated, emits an explosive gas, thereby causing an ever-present fire hazard, particularly dangerous when a gas flame was used to heat the tanks.

The fact that accurate temperature control was absolutely necessary in order successfully to conduct the entire operation aggravated the problem.

The heating tanks are supported by structural steel work above the bench where the batteries are sealed. They are arranged one above the other. The compound is melted in the top kettle and stored in the lower one, from which it flows through tubes to seal the batteries.

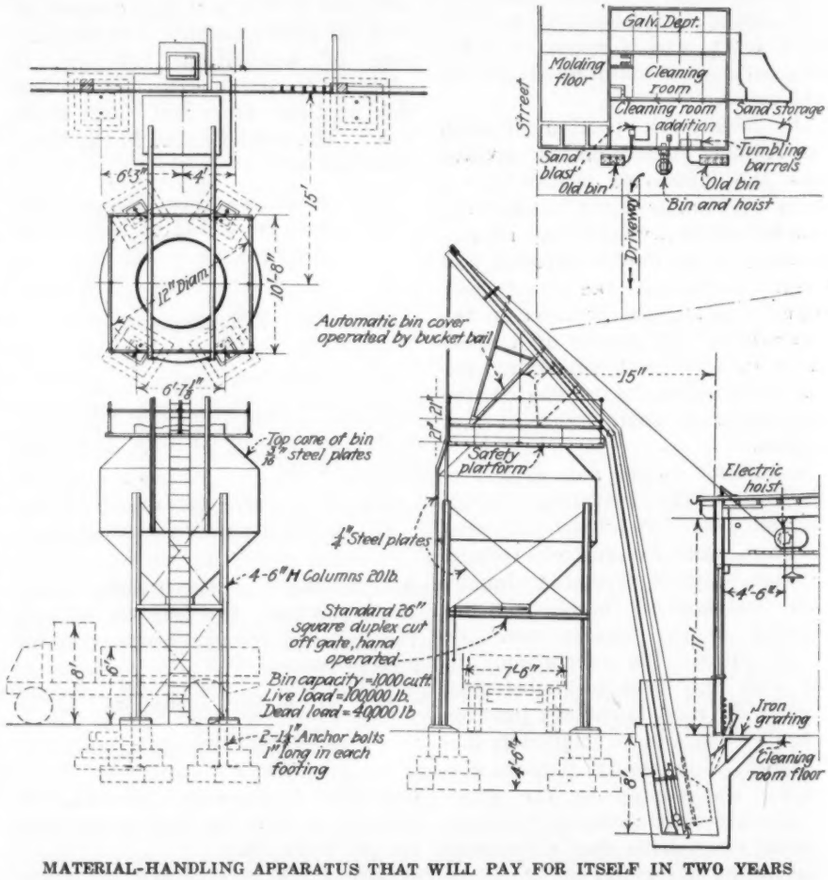
For heating these tanks, gas was tried. It failed because of the fire hazard, the irregularity of gas pressure and the difficulty of control. Steam might have been tried; it at least would have removed the fire hazard, but it would have been necessary to install a superheater in order to get the required temperature and it would, of course, have been exceedingly inefficient. Other fuels had the same disadvantages as gas.

It was found that electric space heaters could be applied easily not only at the bottom but also at the sides, thereby applying the heat where it was needed. Steelclad heaters were clamped to the tubes through which the fluid flowed, thus preventing the mixture from chilling. Thermostats operating through motor switches absolutely controlled the temperature. The thermostats for the top kettles regulated the temperature between 320 deg. and 340 deg., while on the lower kettles the thermostats were set to cut in at 295 deg. and off at 310 deg.

With this arrangement the operation is being carried on much more effectively. The compound flows from the nozzle in a steady, easily controlled stream. The sealing is being done in about one-fourth the time required for the hand-ladle method, a cleaner shop results, and better quality work is obtained.

Refuse-Material-Handling Apparatus

IN A LARGE New England industrial manufacturing plant with an iron foundry as part of the layout, it became necessary to provide an efficient and satisfactory means of loading "black sand" refuse into a dump truck. The term "black sand" is generally applied to that refuse material coming from the cleaning rooms and consists largely of burnt core sand, portions of molding sand, cores, and other sand products that may be dumped from the sand mills, tumbling barrels, etc. Some of it is of a very fine texture and when dry will form into a cloud of dust when disturbed by a breeze.



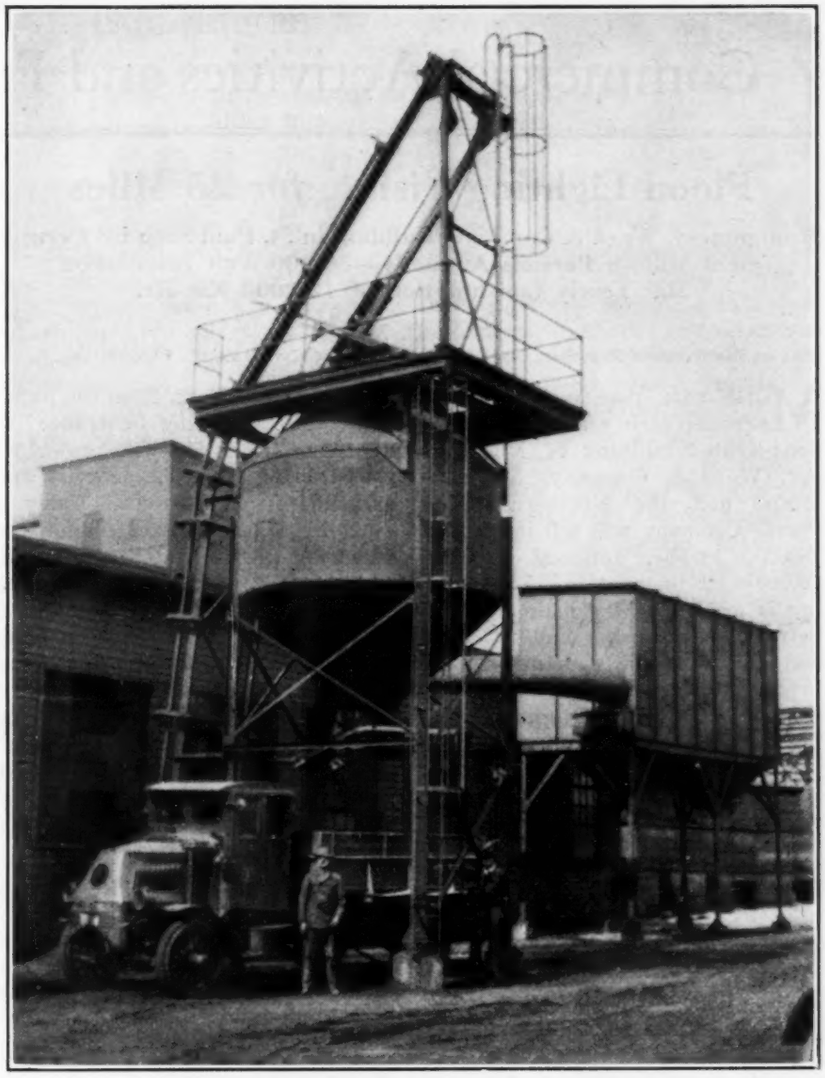
MATERIAL-HANDLING APPARATUS THAT WILL PAY FOR ITSELF IN TWO YEARS

For several months it was the practice of this company to have the refuse hand-wheeled to the rear of the cleaning room on the outside of the building, where it was dumped in a pile.

From this pile the material was shoveled by laborers into a dump truck of three and one-half tons capacity and hauled to a nearby dumping ground. It weighed about 100 lb. per cubic foot, which made it a material of too great a density to handle with small scoop shovels. The laborers much preferred long-handled shovels in order to "save their backs." On account of the fineness of the sand, type of shovel to be used and high sides of truck body over which it had to be shoveled, there was generally a cloud of dust surrounding the loading place.

After a careful analysis of almost all practical methods of handling this material, it was decided to install equipment as shown in the accompanying illustrations. This consists of a circular bin supported on structural steel at a height to permit a dump truck to pass underneath the chute to be loaded. The bin has a capacity of 50 tons, which is approximately two days' accumulation of refuse. It is filled by means of a one-ton capacity skip bucket, which normally rests at the bottom of the concrete pit. Material in the cleaning room is dumped in the vicinity or on the grating over the entrance of the chute that leads to the bucket. The heavy iron grating with 4-in. square openings is necessary in order to have the large sand cores properly broken, as otherwise they would interfere with proper operation of gates in the chute under the storage bin. An electric light is provided at the lower end of this filling chute, by use of which and the 6-in. sight pipe, the operator can easily determine when the bucket is full of material.

The operation of the bucket is semi-automatic. When it is full, the operator presses a button that starts the motor and hoists the bucket to the top of storage bin, where a flap door automatically opens and permits bucket to dump. The controller is provided with an adjustable time relay that governs the period of dumping before the motor is automatically reversed and allows the bucket to complete its cycle of operation by returning to bottom of pit. Each end of travel is provided with a direction switch and an emergency overtravel switch. The hoisting machine also has a slack cable switch.



STORAGE BIN AND HOIST FOR HANDLING FOUNDRY REFUSE

Due to the somewhat severe snow and ice conditions accompanying New England winters, it was necessary to provide a shelter over the bucket and pit. This might have been accomplished by inclosing the entire hoistway with sheet iron or wood. A more economical and very practical scheme was devised by building a wood inclosure directly over the concrete pit walls, as shown in the accompanying illustrations. The sheet-iron door over this space was made to open and close automatically with the respective travel of the bucket. A cast-iron roller formed the counterweight to open the door by gravity when the bucket ascended a short distance. The U-shaped iron sling attached to the under side of door furnished the means of closing the door when the bucket returned to the lower end of travel. The large coil springs in each side of the sling permitted of greater ease in operation and overcame any resultant difficulty when the bucket did not always stop at exactly the same spot.

The apparatus has been in operation about one year and has given most satisfactory results. Its simplicity of construction and operation brings the maintenance factor down to a very low expense. There are very few wearing parts that are affected by the sand. There is no cloud of dust with which to contend. A truck can be loaded in less than one minute by the driver and a helper. Previously it took five men thirty minutes to shovel an equivalent amount of sand and conditions were very disagreeable. The electric power consumption is almost negligible, as it costs about 8 cents for energy to place 25 tons of refuse in the storage bin.

Commercial Activities and Public Relations

Flood Lighting Visible for 25 Miles

Montgomery, Ward & Company Building in St. Paul Seen by Twenty-eight Million Persons Annually—80,000-Watt Installation Has Yearly Consumption of 150,000 Kw.-Hr.

BY R. D. MYERS
Illuminating Engineer, Northern States Power Company, St. Paul, Minn.

MORE than twenty-eight million persons each year will see the flood-lighted building of Montgomery, Ward & Company, St. Paul, Minn., and the Northern States Power Company will sell more than 150,000 kw.-hr. annually for this 80,000-watt installation. The building is located on the main highway between Minneapolis and St. Paul and its owners were quick to appreciate the tremendous advertising value of a large flood-lighted building in such a location. The comparatively dark surroundings set off the building at night as though it were painted a glistening silver.

LIGHTING EQUIPMENT AND INTENSITY

The Montgomery, Ward & Company building really consists of three parts and offers three separate problems in flood lighting: the office building of three and one-half floors; the operating building, directly behind the office building and extending for nine and one-half floors above ground; the tower, at the front of the operating building.

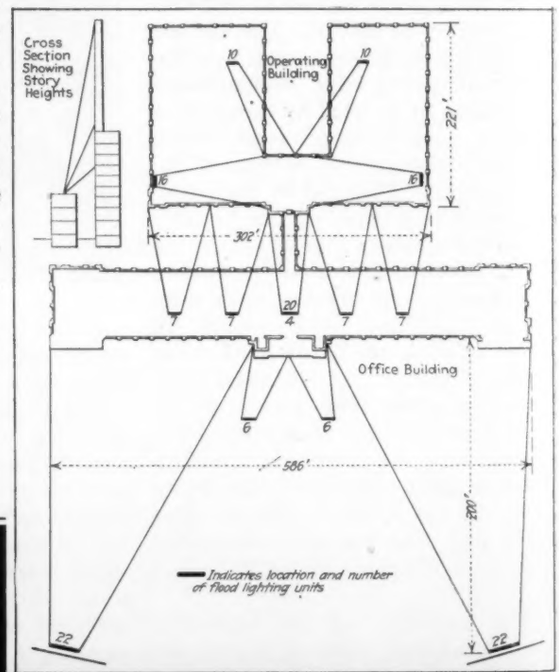
The office building, 580 ft. long and 48 ft. high, with 28,100 sq.ft. of lighted area, is lighted by forty-four 500-watt X-ray projectors, arranged in two banks, 200 ft. from the building. The building entrance is lighted by twelve 500-watt projectors placed 90 ft. from the doorway and arranged in two banks. Using 1 watt per square foot of illuminated area, the 28,000 watts of lighting equipment for the office building produce an average intensity of 3.5 foot-candles at the first floor level, increasing to 4.25 foot-candles at the third floor level.

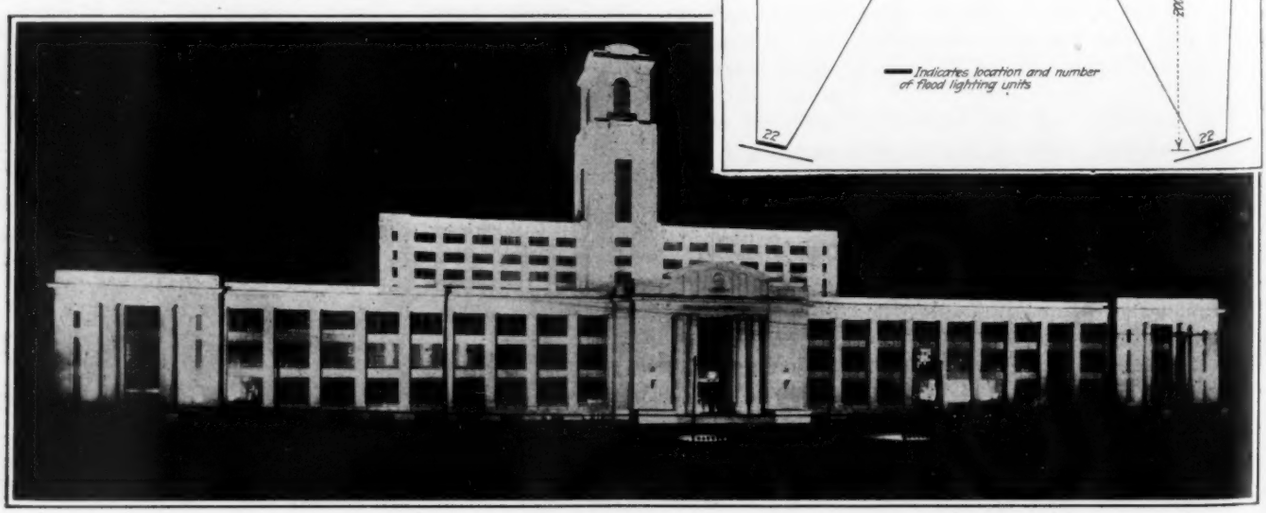
The operating building, located directly behind the office building, has nine and one-half floors above ground, but only the upper forty-five ft. are visible from the street. This building is 322 ft. long with a visible area of 14,500 sq.ft. Thirty-two 500-watt projectors located on the roof of the office building, 120 ft. from the operating building, provide an illumination intensity on the walls of the latter of 9.5 foot-candles.

The tower, 50 ft. in cross-section and rising 134 ft. above the roof of the operating building, is illuminated on all four sides. Each side has an area of 6,700 sq.ft. The side facing the street is illuminated by twenty 500-watt projectors placed on the roof of the office building. Using 1.49 watts per square foot, the intensity of the illumination taken about 25 ft. from the extreme top of the tower averages 16 foot-candles. The south side of the tower is illuminated by two separate banks of ten 500-watt projectors each, placed 140 ft. from the base of the tower and each on a wing of the operating building. At a point 25 ft. from the top, 1.49 watts in lighting equipment per square foot of wall area gives an intensity

AT RIGHT, PLAN OF FLOOD-LIGHTING INSTALLATION USING 160 500-WATT PROJECTORS

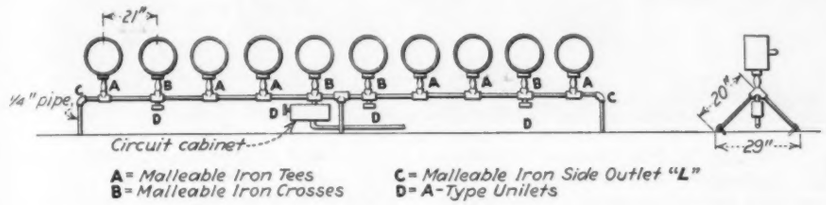
BELOW, FLOOD-LIGHTED MONTGOMERY, WARD & COMPANY BUILDING, ST. PAUL





of 16 foot-candles. The east and west sides of the tower are each illuminated by a bank of sixteen 500-watt projectors placed 140 ft. from the base of the tower. Using 1.19 watts per square foot of wall area, the average intensity produced is 14 foot-candles.

The mounting frames of the projectors are made of 1¼-in. galvanized pipe for the smaller banks on the roof and of 2-in. galvanized pipe for the larger banks on the ground level. The X-ray threaded bases made possible a neat and substantial mounting of the equipment on the pipe supports. The pipe rack itself is used to house the wiring. A



DETAILS OF MOUNTING AND WIRING FOR GROUP OF TEN 500-WATT PROJECTORS

weatherproof circuit cabinet is mounted on each rack. The projectors are mounted on the rack on 21-in. centers, giving ample room for focusing at various angles.

The tower of the building can be seen from all main highways leading into St. Paul and it has been sighted at a distance greater than twenty-five miles. The entire building is made of white concrete with an average coefficient of reflection of 58.5 per cent. The building is soon to be resurfaced with the expectation of raising the coefficient of reflection to 82 per cent. When this is done, the distance at which the building will be visible will be greatly increased. The local manager for Montgomery, Ward & Company reports: "The advertising value of flood lighting the building was far underestimated by us. The appearance of the building at night is very satisfactory and far beyond our expectations."

DETAILS OF FLOOD-LIGHTING EQUIPMENT

Dimensions, Ft.	Area, Sq.Ft.	Total Watts	Watts per Sq.Ft.	Average Foot-Candles
Office building 586x48	28,100	28,000	1	1st floor lever 3.50 3rd floor lever 4.25
Operating building, 322x45 (visible area office building)	14,500	16,000	1.1	9.50
Tower 134x50	6,700	North side 10,000	1.49	16.0
	6,700	South side 10,000	1.49	16.0
	6,700	East side 8,000	1.19	13.0
	6,700	West side 8,000	1.19	13.0
	69,400	80,000		

Total of 80,000 watts and 160 projectors.
Average coefficient of reflection of the building is 58.5 per cent. Resurfacing is expected to raise this factor to about 82 per cent.

Building an Electric Range Load

Sales Methods Found Successful by the Puget Sound Power & Light Company in Increasing Its Range Business—Total of 5,722 Ranges on Company's Lines

BY H. J. GILLE
General Sales Manager Puget Sound Power & Light Company, Seattle, Wash.

THE desirability of the electric range load was recognized by many central stations on the Pacific Coast several years ago and some ranges had been sold from 1917 up to about 1920. It has been only within the past two or three years, however, that any great volume of this business has been developed.

The time has come, in the opinion of the writer, when the central station must recognize the fact that electric cooking and water heating is by far the largest undeveloped field ahead of it. With the wonderful progress that has been made during the last ten years in developing a dependable electric range, this business on some kind of a basis should prove profitable to the central station. The whole question is a problem that is being worked out as other big problems of the industry have been solved.

In January, 1924, the Puget Sound Power & Light Company definitely concluded to push electric ranges vigorously. The company is convinced that if this business can be developed rapidly it will be put on a profitable basis just that much sooner. It is felt that it is necessary to get a fairly high degree of saturation to get down distribution system investment costs to a point where a low energy rate is possible, besides obtaining a higher diversity on power plants and transmission lines.

In 1923 the Puget Sound Power & Light Company succeeded in arousing interest in electric ranges among the builders of apartment houses and their architects and contractors. This was the culmination of a long series of efforts along this line. Since early in 1924 a substantial majority of apartment buildings in this territory have been equipped throughout with electric ranges.

During 1924 the results of the company's several campaigns and its aggressive sales policy were very gratifying, 2,654 ranges having been added to the company's lines. These, in addition to the ranges on the lines at the beginning of the year, brought the total served by the company up to 5,722 on Dec. 31, 1924. With approximately 2,460 added to June 1 of this year, the grand total is now 8,182, including ranges sold but not yet delivered.

To accomplish the 1924 results two compaigns were decided upon, one to be conducted in the spring and one in the fall, to augment the continuous sales throughout the year. During the fall campaign from Aug. 11 to Oct. 15, a total of 1,110 ranges were sold. No special organization was created for the purpose. The central district office prepared the general plan, which was uniformly carried out by the regular organizations of the company's six districts. District and branch office quotas were assigned, and in the central district, which includes the city of Seattle, each regular range salesman was given a quota.

SALES FORCE USED AND COMMISSIONS ALLOWED

The central district used its regular force of four range salesmen, who worked on a 10 per cent commission basis. In addition, for the period of the campaign, the Seattle and suburban contract salesmen, store forces and all other employees of the district were pressed into service by the offer of 5 per cent commission for each sale made and 2½ per cent commission for each lead to a sale afterward completed by a regular range salesman. The five other dis-

tricts had no men regularly working on a commission basis, but utilized all their salaried employees by offering the commissions above mentioned. No temporary salesmen were employed. Manufacturers' salesmen were utilized only to circulate among branch offices, coaching the regular employees.

Advertising and other publicity were handled principally by the company's regular publicity agents. Daily and weekly newspapers were the mediums mostly used. The company's regular billboards were repainted for the campaign and a broadside was mailed to every residence customer during the period of the campaigning. Well-advertised cooking schools were held in every principal city and town.

BASIS OF SALE TO CUSTOMER

The price of the range to the customer was based on cost plus 25 per cent for cash, to which 5 per cent was added if the range was purchased on the deferred payment plan. This was the company's standard basis for range sales at the time. During the campaign the down payment was reduced to $9.75, the balance being payable in not more than eighteen months. It is interesting to note that 86½ per cent of the ranges sold were purchased on the deferred payment plan averaging less than eighteen months.

A flat price of $40 was made to the purchaser for wiring in the range. Certain contractors agreed to do the range wiring at this figure, excluding abnormal jobs. The cost of wiring was carried by the company for the purchaser, at his option, along with the range on the conditional sale agreement. The contractor was paid cash.

It is felt that the success of the campaign was largely due to a series of range educational meetings for all employees, whether engaged in sales work or not, held prior to the campaign at every office and store of the company; enlisting employees other than those regularly engaged in sales work, by allowing commissions for sales and leads; competition among the regular salesmen in the six districts and among branch offices of each district stimulated by bonuses.

During 1925 the Puget Sound Power & Light Company expects to sell 5,000 ranges. A Hotpoint campaign closed June 1, with the sale of 1,062 ranges during a two-month period. With the encouraging results accomplished so far this year and with another campaign to be staged in the fall, the management feel very sanguine over the prospects of reaching the 5,000 mark set.

Public Dedicates New Power Plant

UPWARD of two thousand people—customers, stockholders and business men in the territory served by the California Oregon Power Company—participated in the recent completion of the company's new 30,000-kw. hydroelectric plant at Copco, Cal. For some time the Pacific Coast utilities have felt that public inspection of new power developments has been a helpful means of disseminating knowledge of their business, but in this case the California Oregon Power Company went a step further and invited that public to join in the actual ceremonies.

The dedication took the form of an allegorical representation of the important factors entering into the construction and operation of an extensive power development, showing the relation of the electric light and power company to the public which it serves. Upon completion of this impressive ceremony luncheon was served and the two thousand guests were then conducted in groups over the project.

Power a Small Percentage of Manufacturing Cost

POWER SALESMEN are often confronted with the statement by the prospect that the power rate is too high. An effective answer to this objection has been found by many salesmen in the statement that the cost of power is a very small percentage of the total manufacturing cost, whereas the many desirable and valuable features of purchased power make its use an important advantage to a manufacturer. The relation of power costs to the total manufacturing cost in specific industries is frequently helpful in convincing a prospective power user.

A study of power cost and its relation to total manufacturing costs of twenty-one industrial power users, summarized in the accompanying table, shows that, with very few exceptions, the cost of power is less than 3 per cent of the average manufacturer's production expense. This study was conducted under the direction of H. N. Wood, Pennsylvania-Ohio Power and Light Company, Youngstown, Ohio.

COST OF POWER COMPARED TO TOTAL COST OR GROSS SALES

Company	Business	Cost of Power to Total Cost per Cent
1.	Steel fabrication, metal poles, metal lath, etc.	0.066
2.	Manufacturer of men's shoes	.50
3.	Bakery	.68
4.	Steel fabrication, tanks, tank cars, steel barrels	.81
5.	Stove manufacturing	1.00
6.	Flour mill	1.00
7.	Veneer mill	1.18
8.	Small rubber mfg. (tires and tubes only)	1.35
9.	Leather, tanning and curing	1.5
10.	Tire and rubber manufacturing	1.5
11.	Iron foundry	1.85
12.	Stone quarry	2.8
13.	Steel manufacturing, rolling into billets, slabs, sheet bars	3.0
14.	Milk.—including refrigeration	3.2
15.	Ice manufacturing	26.0 to 33.0
16.	Small electric motor and generator manufacturing	.3
17.	Auto springs	.405
18.	Printing and publishing	.42
19.	Lumber	.44
20.	Steel castings	3.05
21.	Common brick manufacturing	4.9

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Modern Practice in the Design of Control Equipment for Hydraulic Power Stations.—K. E. NYLANDER.—Notes on recent practice in Europe and America in the design of busbars, control panels, load-dispatching elements, etc., with numerous illustrations of actual installations in European power stations.—*Teknisk Tidskrift (Swedish), Elektroteknik,* June 6, 1925.

Diesel Engines and Hydro-Electric Power Stations.—ALFRED BUCHI.—This is an economic discussion. It is shown that in view of variations in available water and in demand hydro-electric plants can usually be advantageously combined with thermal plants. The conditions which prevail when Diesel engines are adopted are especially considered. The comparisons are worked out in the form of charts, taking into account fixed charges and operating costs. The author's main contention appears to be that all factors need to be considered, and he points out what they are, in deciding whether power at a distant point should be supplied over a transmission line from a hydro-electric plant or generated locally from fuel oil.—*Engineer (England),* July 31, 1925.

Conditions Affecting Use of Preheated Air.—While the weight of air theoretically required for complete combustion per pound of fuel varies between wide limits because of differences in composition, the weight per 10,000 B.t.u. is almost the same for them all, as appears from a table accompanying the article. In practice an excess over the theoretical amount must be provided. The volume, however, varies with the absolute temperature, and when the air is preheated this difference must be taken into account in designing the blower equipment. This, for a change from 70 deg. to 300 deg. is an increase in the ratio of 1.43 in volume for the same weight. A numerical problem shows how this affects the pressure needed to force the air through the fuel bed. Several useful formulas are given.—*Power Plant Engineering,* July 15, 1925.

Boiler Furnaces for Pulverized Coal.—A. G. CHRISTIE.—An analysis of the fundamentals of combustion indicates that, for the highest efficiency and maximum capacity of a given furnace, coal should be finely ground, thoroughly dry and preheated. Primary and secondary air should be highly preheated. Turbulence should exist inside the furnace. The walls should be water-cooled. New methods of handling ash and preventing the discharge of dust into the air should be developed.—*Mechanical Engineering,* August, 1925.

Hydro-Electric Development in Finland.—HUGO MALMI.—At Imatra, on the Vuoksi River, a development is in progress which constitutes the first stage of a program expected ultimately to bring about the utilization of 600,000 hp., all within a stretch of 15 miles. The present construction will make 75,000 hp. available, but this can be increased to 216,000 hp. at the same site. The remainder will call for three additional plants. A reliable and steady flow is assured, because the development is directly below the great Lake Saimaa, with an area of 2,000 square miles, which therefore constitutes an excellent natural reservoir. The plant will operate on a net head of 79 ft. The three-phase, 11,000-volt, 24,000-kva. generators are permanently connected to three-phase transformers that step up the voltage to 120 kv. Transmission distances are in excess of 200 miles, most of the power being sent to West Finland. The line for this service runs 136 miles and then divides, one branch going 98 miles farther, the other 88. Another line from the power station runs 32 miles to the town of Viborg. To avoid a double voltage system this also will be operated at 120 kv. As a reason for the selection of 120 kv. instead of a higher voltage for the long line the author says that the large number of substations makes this the most economical and that even at this voltage the leading current for the system (354 miles) represents 20,000 kva. Open-air switching is to be used.—*World Power,* August, 1925.

Generation Control, Switching and Protection

"Erste Brünner" Steam Turbine.—E. A. KRAFT.—It has been established by recent experiments that the steam velocity is of fundamental importance for efficiency and that the losses are a mimimum at relative steam velocities of 100 m. to 140 m. per second. This has led manufacturers to depart from the earlier construction when the highest efficiency was demanded. A test of a turbine of the new type by Professors Stodola and Josse is stated to have shown an extraordinarily good thermodynamic efficiency. The small heat drops which correspond to the low steam velocities take place in a large number of stages, which are arranged in two, three or four separate turbines. The greatest improvement in efficiency is in the high-pressure part, in which there are a large number of single-staged wheels with full admission and low peripheral velocity. An illustration is given of a 13,000-kw. four-part installation, the length of the turbine being 38 ft.—*Electrician (England),* July 17, 1925.

Variation of Power-Station Efficiency with Output.—R. H. PARSONS.—Using as his working material the actual figures from a central station, the author describes a simple semi-graphical method of analyzing its performance to determine the over-all efficiency curve. Since it was found that this fell off at the higher loads, he shows how the same procedure may be used to discover which element of the plant is responsible for the decrease. The method is of interest because it makes use of an entire month's running, without requiring a detailed study of the data for each individual day or shift, and substantially eliminates the effects of fortuitous fluctuations. The plant studied was the Bow station of the Charing Cross Electricity Supply Company. From the log the coal consumption for each shift is plotted against the corresponding kilowatt-hours. The resulting points fall into three clearly defined groups of low, medium and high output. Those of the last group are distinctly out of line with the others, whence it is evident that the station departed from the "straight-line law" when the loads were large. Since this law, though representing quite accurately the relation between output and fuel consumption of a station over the usual range of load, represents a continual increase of efficiency with increasing load, a departure from it does not necessarily indicate a decrease in efficiency. This matter must, therefore, be determined. Through the center of gravity of each of the groups of points a curve is drawn, its constants being computed on the assumption that it is of the form $y = A + Bx + Dx^3$. In the present case it works out as $C = 26.159 + 1.401K + 0.0000325K^3$, when C is the coal and K the net kilowatt-hours per shift. This may be regarded as the typical performance curve of the station.

The lower part is substantially a straight line and may be regarded as the plant's standard line. The load for maximum efficiency is given by the point of contact with the curve of a tangent through the origin. The "standard" and the actual curves of coal per kilowatt-hour are obviously immediately obtainable, and the manner in which the latter rises with the larger loads becomes evident. Using the evaporation as representing the output of the boiler room and the input to the engine room, the same method can be applied to investigate the performance of these parts of the plant separately. The average thermal efficiencies actually obtained were, for the light shifts, 13.5 per cent; for the medium, 17.4; for the heavy, 16.3. The highest was 17.41—*Engineering (England),* July 10, 1925.

Transmission, Substations and Distribution

Rectifiers.—Beginning with the simple single-phase bulb and following this with diagrams and a description of three-phase rectification, these articles trace the development of the mecury-vapor rectifier through its application in the automatic substation. The author confines himself to an exposition of the glass-bulb rectifier, which, he states, can be made for an output up to 75 kw. at 500 volts. Much of the second article is devoted to a description of the part played by various relays and regulators in automatic working.—*Engineer (England),* July 24 and 31, 1925.

Electrodynamical Forces in Busbars.—FREDRIK DAHLGREN.—The author investigates the forces to which current-carrying conductors are subjected in ordinary operation and in case of short

circuits. Special attention is given to the possible combinations giving mechanical resonance in the conductors themselves and in their supports. The final results are given in a general formula involving a resonance function, which is determined for the most important cases of loading and suspension. This resonance function assumes theoretically infinite values for combinations of dimensions which produce resonance. The critical free length of conductors corresponding to these combinations is also given.—*Teknisk Tidskrift (Swedish), Elektroteknik*, July 4, 1925.

Grounding the Neutral.—EDGAR D. SIBLEY.—The method by which noise on a telephone circuit caused by harmonics in an adjacent power circuit was eliminated is described. The noise began with the grounding of the neutral of a generator at the West Reading power station of the Metropolitan Edison Company. Oscillograms showed the presence of a number of harmonics in the current through the neutral, of which the fifteenth and thirty-third were prominent. Further, the length of the line was such that it might resonate at the higher harmonics of the generator and thus make their effect more pronounced. Two filters were designed, corresponding to the most troublesome harmonics, and inserted in the ground connection, whereby the interference was reduced to such an extent that it was no longer noticeable. Data on the filters are: For the fifteenth harmonic (900 cycles), sixty-two turns of 105,000-circ.mil cable composed of 259 strands of No. 24 wire on a micarta tube of 20 in. outside diameter and 23 in. long, giving a 60-cycle reactance of 0.563 ohm, in parallel with an oil-filled condenser of approximately 20 mfd.; for the thirty-third harmonic (1,980 cycles), fifty-three turns of similar cable on a tube of 13.5 in. outside diameter and 20 in. long, the 60-cycle reactance being 0.236 ohm, with 10 mfd. in the form of two 20-mf. condensers in series. Impedance curves of the filters individually and in series, also oscillograms showing the change in the current, accompany the description. —*Iron and Steel Engineer*, Aug., 1925.

The Transverter. — J. HÄRDÉN.—Notes on the principles and the performance of the transverter (apparatus for transforming three-phase, high-tension current to high-tension direct current for transmission purposes and then reconverting the energy to low-tension, three-phase current), invented by Highfield and Calverley.—*Teknisk Tidskrift (Swedish), Elektroteknik*, July 4, 1925.

Illumination

Essentials of Good Street Lighting. —L. B. W. JOLLEY.—This concluding section (Part III) of a series considers the street-lighting question from the aspect of the public lighting authority. A simple analytical study assuming the criterion that the vertical illumination under one lamp shall be equal to the horizontal illumination midway between two lamps leads at once to a definite kind of distribution curve which with incandescent lamps can be obtained only by the use of refractors. After the theoretical requirements have been met, however, the final tests for the effectiveness of street light are visibility, discrimination and absence of glare, and since a gain in visibility and discrimination often automatically involves an increase in glare, a compromise is the only solution.—*World Power*, August, 1925.

Motors and Control

Overload Capacity of Polyphase Induction Motors.—L. DREYFUS.—The author derives a new formula for the overload conditions in polyphase induction motors. It is obtained by evaluating the mathematical relations between primary and secondary resistances, reactances and leakages, giving maximum output to the rotor. The new formula is especially convenient in computing the maximum torque from no-load and short-circuit tests.—*Teknisk Tidskrift (Swedish), Elektroteknik*, July 4, 1925.

Foreign Steel-Mill Practice.—W. H. BURR and F. L. ESTEP.—*Electrical Drive for Rolling Mills.*—H. C. UHL.—*Observations on Rolling-Mill Drives in Continental Europe.*—O. NEEDHAM.—These are companion papers containing a large amount of detailed information contrasting European with American practice. Comment is made on the more extensive use abroad of wound-rotor induction motors with short-circulating and brush-lifting devices, of liquid rheostats, of commutator alternating-current motors and of complicated arrangements for control if their use shows sufficient saving of power. Adjustable-speed drives are frequently used, because one mill is usually called upon to roll a variety of products. Various schemes are used for obtaining adjustable speed with wound-rotor machines, notably the Kraemer, and, in conjunction with commutator motors, the Scherbius. A much greater use of mercury-arc rectifiers is made in Europe than in this country, especially in large power units. Up to 250 amp. glass containers are used, above that either several rectifiers are operated in parallel or iron containers are used. Schemes for power-factor correction are used more than in this country, not only in the employment of overexcited synchronous motors for drives, but by phase advancers in the secondaries of induction motors.—*Iron and Steel Engineer*, August, 1925.

Electrophysics, Electrochemistry and Batteries

Effect of Tension Upon Magnetization and Magnetic Hysteresis in Permalloy.—Wires of five nickel-iron alloys containing 45, 65, 78.5, 81 and 84 per cent Ni, 60 cm. long and 0.1 cm. in diameter, were studied by a ballistic method for tensions up to 10,000 lb. per square inch and fields up to saturation (10 gauss to 20 gauss). Permalloy with 81 per cent Ni is nearly indifferent to tension in its magnetic behavior; permalloy with less nickel is more easily magnetized and has less hysteresis when under tension, while 84 per cent permalloy is magnetized with more difficulty and has greater hysteresis when under tension. The saturation values are independent of the tension. In 78.5 per cent permalloy, under a tension of 3,560 lb. per square inch, saturation is reached at only 2 gauss and is practically complete at 0.2 gauss, and the hysteresis loss is only 80 ergs per cm^3 per cycle. (X-ray examination proves that this abnormally low loss is not due to any peculiar orientation of the crystal axes as the crystals are found to be oriented at random.) Magnetostriction behavior can be deduced from these results. Above 81 per cent Ni permalloy contracts like Ni; below 81 it expands like Fe.—*Physical Review*, August, 1925.

Telegraphy, Telephony, Radio and Signals

Development of Valves for Wireless. —B. S. GOSSLING and M. THOMPSON.—In this second and concluding installment the history of the electron tube is traced from the war-time development to the present. The ground covered includes the successive improvements in vacuum pumps to that of Langmuir of 1916, studies of electron emission from tungsten, "thoriated" tungsten and oxide-coated platinum, and the determination of design formulas. Under the head of recent developments, receiving valves and transmitters are treated separately. The latter, in large installations, may be operated in groups if precautions are taken to prevent high-frequency oscillations between the tubes. Mention is made of one installation having fifty glass valves in parallel and of others with six silica valves in three parallel series of two each. The final conversion to radio frequency is from a direct-current supply at 10,000 volts to 15,000 volts and has an efficiency of 70 per cent.—*World Power*, June, 1925.

Miscellaneous

Diesel-Electric Pipe-Line Dredge "Clackamas."—JAMES H. POLHEMUS.—This dredge, built of steel, 236 ft. long, of 50 ft. beam and displacing 2,480 tons at 7-ft. 8-in. draft, is designed for operation at the port of Portland, Ore. There are four direct-current, constant-voltage, compound-wound, commutating-pole generatiors each direct-connected to a Diesel engine. Two, of 540 kw. each, are driven by 800-b.hp. engines at 200 r.p.m., and two, of 610 kw., by 900-b.hp. engines at 150 r.p.m. These deliver power at 500 volts to the main bus. About 85 per cent of the power is taken for the operation of the main pump motor. The remainder is supplied at 250 volts, with the aid of a balancer set, to the smaller equipment. The pump motor is a 2,700-hp., 250-r.p.m. to 360-r.p.m., 500-volt adjustable-speed, compound-wound, direct-current machine direct-connected through a flexible coupling and marine horseshoe-type thrust bearing to the dredging pump. The cutter motor is a 250-hp., 275-volt shunt-wound, separately excited machine with Ward-Leonard control. Diesel-electric operation permits of greater flexibility, lighter weight of machinery and higher economy than steam, even when the latter is produced by cheap hog fuel from the sawmills. The *Clackamas* delivers power to the pump at 72 per cent of the cost per horsepower on other dredges.—*Mechanical Engineering*, August, 1925.

News of the Industry

Will Push Balch Station

San Joaquin Corporation Will Finish First Part of Kings River Project by 1927

ENGINEERING plans for the Balch power house of the San Joaquin Light & Power Corporation on Kings River, in the heart of California, are complete, and actual work is to be started at once and pushed so that the plant will be brought on the line January 1, 1927. The cost of the new power house is estimated at $4,850,000. This plant has been selected for the initial work of the development because of its extremely high head and short tunnel, which offer simultaneously cheap construction and high efficiency. The Balch plant will have a static head of 2,470 ft., higher than that of any existing hydro plant in America. To develop this head 19,550 ft. of tunnel must be bored, which will be through very hard granite, requiring no lining whatever. The ultimate installation at Balch will be four units fed from the North Fork and two from the West Fork. One unit is to be installed at a time, and each will have a rating of about 37,500 hp. The ultimate rating of the Kings River project is 495,600 hp.

Difficulties of Construction

Piedra, a little settlement built around rock quarries and crushers on the river about 25 miles from Fresno, is the nearest railroad point. From here it is planned to haul all material to the project over a wagon road the latter part of which belongs to the company and has been built at much expense, the river being bridged three times and three trestles built over ravines.

A steel-tower aluminum-cable 110,000-volt transmission line was constructed in 1923 from Piedra to Balch Camp, at the junction of the two streams, a distance of 24½ miles. This line now serves power for construction work. It is planned to build another 13 miles from Piedra to the Sanger substation, at which point the Kings River plants will feed into the San Joaquin system. This will be the main transmission line. Sanger substation is in the very center of the company's system, only 31 miles from the Balch plant. This short transmission line presents one of the great advantages of the Kings River project.

Opposition to Diamond Creek License Not Intense

With increasing indications pointing to the issuance of the Girand license covering the water-power project on the Colorado River at Diamond Creek, there is said to be a somewhat general realization in Arizona that no objection to this license can be justified. Ward Bannister and a small following in Colorado are said to be the only ones in that state who have felt that Colorado's interests cannot be safeguarded by conditions provided for in the license. California, it is said, is hesitating in its plan to present witnesses in opposition at the hearing on October 20. In the hands of skilled examiners it is feared that its position may be made to appear a selfish one. The granting of the Girand license will admittedly weaken the position of Governor Hunt of Arizona in opposition to any interstate agreement in which a preferred position is not accorded to his state.

American Power & Light Buys Superior (Wis.) Plant

Purchase of the Superior (Wis.) Water, Light & Power Company by the American Power & Light Company of New York removes from the field of independent operation one of the few Wisconsin utility companies of respectable size remaining in that class and puts on a settled footing a property that has been much advertised because of the efforts made by the municipality to acquire it and the litigation which resulted. After long-drawn-out agitation the citizens of Superior voted in 1922 to purchase the plant, but when a value of $3,500,000 was put upon it by the company the city government appealed to the Railroad Commission for authority to obtain the property by condemnation proceedings. The case was fought through the state courts to the United States Supreme Court, which rendered the final verdict in favor of the company. This led to another vote being taken in April of this year, when the original decision to buy was rescinded by a great majority.

The Superior Water, Light & Power Company furnishes electric, gas and water service in Superior and the outlying communities of Itasca, South and West Superior, having a population of 40,000. Demands for energy above the capacity of its steam plant have been met by purchase from the Great Northern Power Company of Duluth. While neither the price paid for the Superior company nor future plans were disclosed, the purchase would obviously fit in with the development of an interconnected area covering southern Minnesota and northern Wisconsin inasmuch as the American Power & Light Company controls the Minnesota Light & Power Company, operating numerous electric plants in the vicinity of Superior. It also gives a foothold in Wisconsin to a fifth major public utility holding company.

Vice-president William H. Winslow of the Superior company announces that the Superior properties will continue to be operated by their own organization with no changes in the staff and personnel.

World Power Organization

Draft of Proposed Constitution Establishes No Central Authority, but Only Clearing House

IN SUBMITTING to the various countries a draft of a constitution for the permanent organization of the World Power Conference it is pointed out by the organizers that the central office is to be nothing more than a clearing house for the interchange of information on all matters relating to the development of power resources. The conference is to be composed of the existing national committees together with such other national committees as may be formed hereafter. Where no national committee exists the government or some representative institution may appoint a representative for the country.

The constitution will place no restriction on the type of national committee each country may choose to select, but it is recommended that each member have some first-hand knowledge of scientific, technical or industrial power problems. The management of the affairs of the conference is to be vested solely in the national committees. Much emphasis is placed on the determination to have no central superorganization. The international executive council is to consist of one representative from each national committee.

Choosing the President

It is proposed that the president of the conference shall always be chosen from the country in which a plenary conference is held. The selection is to be made by the national committee of that country. For instance, the Earl of Derby is to be president at the next plenary conference by virtue of the fact that the last plenary conference was held in Great Britain. Each national committee is to designate a vice-president of the conference for such period as it may see fit.

The international executive council is to select its own chairman. At its recent meeting in London it selected D. N. Dunlop for that place. Mr. Dunlop was the organizer of the first World Power Conference. The council also, it is proposed, may appoint as vice-chairman the representative on the council of the national committee of the country in which a plenary conference or sectional meeting is being held at the time.

It is proposed further that the chairman of the council be allowed to appoint the necessary staff for carrying forward the work of the conference. The council will determine the location of the central office, which is to remain in London until otherwise decided. The council will determine the basis upon which member companies shall contribute to the support of the central office.

E. W. Lloyd Will Head Commercial Section of N. E. L. A.

Acceptance by E. W. Lloyd of Chicago of the nomination tendered him by President Davidson as chairman of the Commercial Section, National Electric Light Association, completes the list of those who will head the national sections for the year now entered upon. As previously announced in the ELECTRICAL WORLD, M. S. Sloan will be chairman of the Public Relations Section, C. F. Hirshfeld of the Technical Section and C. M. Breitinger of the Accounting Section. Mr. Lloyd, who for many years has been general contract agent for the Commonwealth Edison Company, was previously chairman of the Commercial Section, in 1912-13, and was president of the association in 1915-16.

Recently appointed chairmen of N. E. L. A. committees whose acceptances have not previously been noted in the ELECTRICAL WORLD are:

SPECIAL NATIONAL COMMITTEES

Exhibition.—C. L. Peirce, Pittsburgh.
Water-Power Development.—W. E. Creed, San Francisco.

GENERAL NATIONAL COMMITTEES

Membership.—Howard K. Mohr, Philadelphia.
Rural Electric Service.—G. C. Neff, Madison, Wis.

PUBLIC RELATIONS NATIONAL COMMITTEES

Customer Ownership.—A. Emory Wishon, Fresno, Cal.
Industrial Relations.—Homer E. Niesz, Chicago.
Information Bureau Organizations.—H. C. Abell, New York.
Public Relations Advertising and Information.—W. H. Hodges, Chicago.
Manufacturers' Advertising.—J. C. McQuiston, East Pittsburgh, Pa.
Public Speaking.—W. S. Vivian, Chicago.
Relations with Financial Institutions.—M. S. Sloan, Brooklyn, N. Y.
Women's.—Miss Elizabeth Lee, Birmingham.

Chairmen of the Commercial National Section committees have not yet been announced.

Niagara Frontier League to Have Lighting Exhibit

The Electrical League of the Niagara Frontier, with headquarters in the Curtiss Building, Buffalo, will soon announce an industrial lighting exhibit to begin September 15 and continue over a period of six months. A room, 60 ft. x 20 ft., on the top floor of the Curtiss Building will be remodeled, with sections to imitate various factory and industrial construction, such as dirty brick, white interior, plain wood, etc. Supplementary to this will be installations of correct and incorrect lighting equipment and arrangement, controlled from a large central switchboard.

A campaign to have executives and industrial managers visit the exhibition will be conducted, and there will be lighting engineers at headquarters who will make surveys of lighting problems and submit reports without charge. In addition there will be short lectures and informal talks on the subject of industrial lighting, illustrated by moving pictures and stereopticon slides. The program of the league will fit in with the extensive campaign to be carried on nationally by the industrial lighting committee of the National Electric Light Association. Karr Parker is chairman of the industrial lighting committee of the Niagara league.

Progress on Bartlett's Ferry Hydro-Electric Plant

Steady progress is being made in the construction of the Bartlett's Ferry dam and generating plant of the Columbus Electric & Power Company, 16 miles north of Columbus, Ga. The dam will, when completed early in 1926, have an over-all height of 130 ft. with a head of 120 ft. The over-all length will be approximately 1,940 ft., including a headworks section of 360 ft. The spillway section, containing twenty-two gates, will be 600 ft. long and the earth section will be 980 ft. in length. The pondage will be 6,400 acres, or 10 square miles, providing a storage for supplemental river flow of more than 4,000,000,000 cu.ft.

The power house will have an initial capacity of two 20,000-hp. units and an ultimate capacity of four such units. The entire cost of the project is estimated at $7,500,000. A 35-mile transmission line connecting the Bartlett's Ferry power plant with the tie line of the Central Georgia Power Company terminating at Manchester, Ga., has already been completed. This is a single circuit, 115,000-volt, three-phase, sixty-cycle steel-tower line and cost $300,000. The entire construction work is being done by Stone & Webster, Inc.

Proposed Power Projects Seek Rights in California

J. N. Turner, San Francisco, has applied to the California Department of Public Works for permission to divert 37.5 sec.-ft. and to store 6,400 acre-ft. of water in Plumas County from Jamison, Downieville Fork, Deer and Bear Creeks, all tributary to the Middle Fork of the Feather River. This project is estimated to cost $100,000.

The Western States Gas & Electric Company, San Francisco, has applied for permission to store annually 7,500 acre-ft. from Silver Fork, tributary to the South Fork of the American River, for diversion in connection with its El Dorado County power project.

The Feather River Power Company, San Francisco, has filed application for a permit to store 80,000 acre-ft. of water per annum from the Middle Fork of the Feather River to be diverted in connection with its proposed hydro-electric power project in Plumas County, to cost $1,250,000.

In connection with its Kings River project, which it is estimated will cost $10,000,000, the San Joaquin Light & Power Corporation, Fresno, has applied for authority to divert 330 sec.-ft. of water from the North Fork of the Kings River, Fleming Creek, Post Corral Creek and Helms Creek, tributary to the North Fork of the Kings River and Kings River, and for 86,000 acre-ft. storage per annum, in Fresno County, for generation of 60,750 theoretical hp.

Operation Begins at Wilson Dam

Drying Process Under Way on 25,000-Kw. Unit Without Waiting for Pool to Fill, in Effort to Combat Power Shortage—Further Curtailment of Power in South

IN AN effort to relieve the power shortage in the Southeast to the extent of its ability, the War Department on Saturday last, August 29, began the operation of one of the main Westinghouse 25,000-kw. generators in the government's hydro-electric plant at Muscle Shoals. It was expected that ten days would be required for the drying-out process. There is some uncertainty as to the amount of power which can be developed with the pool 11 ft. below the regular operating level. Estimates vary from 12,500 kw. to 18,000 kw. for the 25,000-kw. unit.

The lines connecting Muscle Shoals with the transmission systems of the region can carry 85,000 kw. To meet the present shortage the steam plant leased by the Alabama Power Company has been made to produce 65,000 kw., 5,000 kw. more than its rated capacity, but this is not regarded as good operating practice, and output is to be reduced to 60,000 kw. as soon as possible. Were two of the four 25,000-kw. generators at Wilson Dam operated at half their rated output, the maximum capacity of the transmission line could be utilized at all times. This would provide for continued delivery of some power during the periods that it will be necessary to shut down one of the units during the tests. Existing installation, however, permits of the operation of only one generator at a time. Simultaneous transmission of power from two or more generators must await the completion of a portion of the switchboard.

The unit started on August 29 is known as No. 2. It will be operated continuously with three shifts of men. Unit No. 4 will be ready to start the drying process as soon as No. 2 goes on full load. The probabilities are that the test of the No. 4 generator and wheel can be begun by October 1. Units No. 1 and No. 3 will follow at ten-day intervals.

FURTHER CURTAILMENT IN CAROLINAS

From Charlotte, N. C., it was announced by C. I. Burkholder, vice-president of the Southern Power Company, that a further curtailment of the use of power and a shift of the schedule so plants will not have to halt operations in the middle of the week would begin on Thursday, September 3, at noon. The further curtailment, which will amount to two days instead of the one announced previously, is necessitated by the growing seriousness of the water shortage. The curtailment will mean that the plants supplied with power by the Southern Power Company will operate only three and one-half days each week, since they usually close down Saturday at noon.

Still more drastic restrictions may soon be necessary unless rain relieves the situation. Three hundred textile mills, operating nearly six million spindles, are affected by the order.

Electrical Subsidiaries of the Porter Interests to Merge

H. Hobart Porter, president of the American Water Works & Electric Company, said on Wednesday of this week, following a meeting of the board of directors, that steps had been taken looking to the amalgamation of all of the electric subsidiaries of that company through the organization of a new concern to be known as the West Penn Electric Company. The new company will acquire all the common stocks of the present subsidiaries, which occupy a dominant position in respect to power mergers in part of the industrial territory of Pennsylvania, Maryland and West Virginia, together with all the common stocks of the Potomac Edison Company and the Keystone Power & Light Company.

Baker River Plant Will Probably Be Complete in October

Completion of the Baker River plant of the Puget Sound Power & Light Company, Seattle, is expected early in October in spite of the numerous construction difficulties that have been encountered. Erection of the dam has been retarded at both ends, on the west by the necessity of keeping the railroad open and on the east by additional excavation found necessary at high level. This dam, which is one of the highest ever built of the "overpour" type, if not the highest, is 234 ft. from lip of spillway to stream bed below. About 1,300 men are at work, which, however, is 300 below normal for this stage of the construction, the shortage being due to the demand for men to fight forest fires. The transmission line lacks only two miles of completion.

Logan (Utah) Municipal Plant May Pass Out

Recommendation that the city of Logan, Utah, dispose of its municipal electric light plant and that steps be taken at once to submit to the people a proposition for disposition of the plant has been made by the special electric light plant committee of the Logan Chamber of Commerce to the chamber's board of directors. The report, submitted after several months of investigation, states that the conditions under which the plant is operating are "decidedly uneconomic" and adds: "In order to continue under such conditions the tax levy from year to year will be an excessive burden on the people and will inflict penalties upon taxpayers that will, in all probability, fail to stand the test of law should the matter be submitted to the courts."

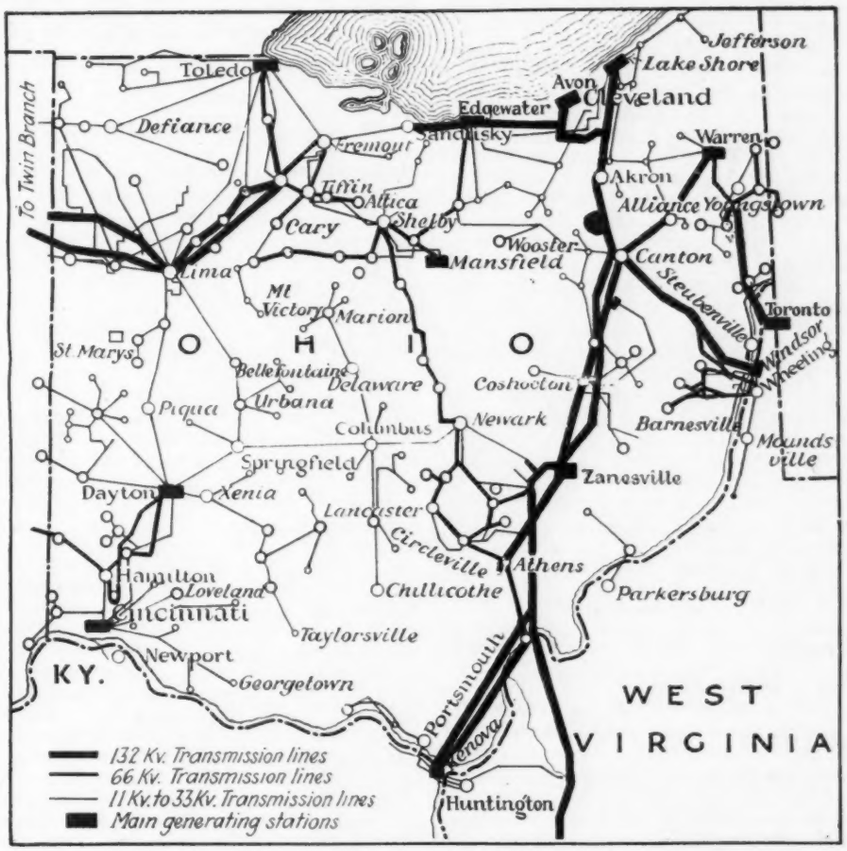
Large sums will be needed to keep the plant in repair, according to the report, and it is not believed feasible to increase the capacity of the plant or to eliminate the competition now offered by the Utah Power & Light Company.

Ohio Takes High Rank Electrically

Completion of Avon, Philo, Toronto, Miami Fort and Scioto Plants Will Provide the Buckeye State with Ten or More Major Generating Stations, Serving Every District

SUPERPOWER in the proper acceptation of the term is rapidly becoming a reality in Ohio, for within a short period of time a veritable network of interconnected high-tension transmission lines will cover the state. As has been from time to time made evident in the news columns of the ELECTRICAL WORLD, the next year or two will witness the completion of several big electric generating plants in Ohio each of which will cost from $10,000,000 to $30,000,000. These new stations, with the many large generating plants now in operation, will assure an adequate supply of electric power for virtually every community within the state. Already the Ohio River has been tied in with Lake Erie through a 132,000-volt transmission line connecting the northern part of the state with the southern. In the first six months of this year the electrical industry in Ohio was authorized by the Public Utilities Commission to issue securities to the amount of $33,973,752. This capital is being raised in large part through the sale of securities to customers, employees and the general public.

Work is proceeding rapidly on the thirty-million-dollar plant of the Cleveland Electric Illuminating Company at Avon, 20 miles west of Cleveland, on Lake Erie. The Union Gas & Electric Company of Cincinnati is likewise rushing construction on its Miami Fort power station on the Ohio River about 20 miles west of Cincinnati. The estimated cost of this power station proper is $12,000,000, and the estimated cost of the transmission lines is $666,-000. The construction schedule calls for two units to be placed in operation before the end of this year. On the Muskingum River, west of Zanesville, the Ohio Power Company is completing one of the largest generating stations in the Middle West, the Philo plant, which will serve numerous Ohio cities. This plant is now tied in with the western distribution system of the American Gas & Electric Company by a line to Crooksville, and also with the eastern system, by a line to Kent. The big Toronto power station on the Ohio River in Jefferson County, about 40 miles south of Youngstown, which is now completed, cost in the neighborhood of $11,000,000. The plant was constructed by the Ohio River Edison Company and is being operated by the Pennsylvania-Ohio Power & Light Company under a long-term lease.



OHIO POWER STATIONS AND TRANSMISSION LINES EXISTING AND UNDER WAY

the Millersford station of the Dayton Power & Light Company at Dayton. Through construction at Scioto and by merger the Columbus Railway, Power & Light Company also will become one of the important links in the state's electrical development.

Ohio River Edison Company Tells of New Contracts

Commenting on the completion of the Toronto (Ohio) power plant of the Ohio River Edison Company, associated with the Pennsylvania-Ohio electric interests, R. P. Stevens, president of the Republic Railway & Light Company, holding company of the various properties, said the other day:

"The completion of the initial installation at the new Toronto power plant has made it possible to negotiate for certain large power contracts, and of these three have been closed. A five-year contract with the Youngstown Sheet & Tube Company provides for a minimum load of 10,000 kw. beginning next January. It will probably reach 20,000 kw. during the life of the contract. Other contracts, with the Sharon Steel Hoop Company and the Westinghouse Electric & Manufacturing Company, provide for a large increase in the power load from these companies, adding approximately $105,000 gross for the rest of 1925. It is estimated that these three contracts alone will produce over $600,000 gross revenue for the calendar year 1926. On June 19 a new ten-year street-lighting contract was closed with the city of Youngstown providing an immediate increase of $33,000 in gross revenue annually, while extensions and improvements to the present street-lighting system should add further revenue."

Legislation in Georgia Affecting Public Utilities

Before adjournment last week the Georgia State Legislature passed a bill giving hydro-electric power companies the right to condemn property, including public highways, that stands in the way of water-power developments, particularly ponding areas to furnish storage. Hitherto power companies wishing to construct dams and reservoirs in Georgia had to obtain permission from the Public Service Commission in order to condemn lands. Not infrequently, in cases where public highways were involved, they had to secure permission from the State Legislature. It was possible for an occasional landowner to secure an exorbitant price and sometimes to hold up the whole deal by refusing to sell at all. The new measure is welcomed by the power companies, even though an amendment permits consequential damages such as good-will and sentimental value.

Another measure passed authorizes Crisp County to issue $1,250,000 worth of bonds for the construction of a dam and hydro-electric power plant on the Flint River between Drayton and Burke's Ferry. The proposal is an innovation in Georgia in that it contemplates the entrance of an entire county into the power field instead of a municipality. L. L. Ferree, manager for the South Georgia Public Utilities Company at Albany, Ga., has made a careful analysis of the proposal and is of the opinion that if the county should finally go ahead with the undertaking, it would have to charge 15.7 cents a kilowatt-hour in order to break even on its investment.

Several bills were passed which will be of indirect benefit to public utility companies. One of these, the charter extension bill, gives the Secretary of State power to extend the charters of business corporations for twenty years at twenty-year periods. Under the old law a minority of stockholders might force liquidation at the end of the first twenty years. Another new law gives corporations in Georgia the right to merge with those outside of the state, and a third gives corporations the right to issue non-par stock.

Progress in Mississippi

Hydro-Electric Possibilities of the State Enhanced by Project at Bear Creek

MISSISSIPPI, which has been ranked well toward the foot of the list of states in the matter of potential water power, seems likely to move up several notches. The figure accepted until recent months was 75,000 hp., of which about 10,000 hp. was reported as developed. The application of the Mississippi Power Company, a subsidiary of the Alabama Power Company, to the Federal Power Commission for a permit for a project on Bear Creek, which is a part of the Tennessee River, in the northeastern corner of the state, has called attention to this previously unrecognized source of power. The Mississippi Power Company asks for authority to construct a dam at this point at an estimated cost of $22,000,000. As previously reported in the ELECTRICAL WORLD, the plans filed with the commission call for the construction of a dam 50 ft. high and a mile long. The initial capacity is put at 70,000 hp. and the ultimate capacity is estimated at 240,000 hp.

The company's program, as outlined by Barney E. Eaton, its president, calls for the construction of four high-voltage trunk transmission lines, the extension of these lines to serve communities, and the ultimate tying together of all its lines into one interconnected power system. The company has recently completed its line from the Muscle Shoals district in Alabama to Iuka. It is planned to extend this line to serve other communities in northeast Mississippi. Another trunk line will be constructed to serve the cities and towns lying to the north, west and south of Columbus. Meridian, Laurel, Hattiesburg and other communities in east central and central Mississippi will be served from a third line now under construction and scheduled for completion by December 20. The Gulf Coast will be served by the fourth trunk line, which will extend into Gulfport.

The Mississippi Power Company's system will be connected at the Alabama state line with the Southeastern interconnected system which now has a generating capacity in excess of 2,000,000 hp. and undeveloped power resources of many times that amount.

To Expand Water Resources Work of Geological Survey

A bill providing for "an inventory of the water resources of the United States" will be introduced at the forthcoming session of Congress. The proposed legislation authorizes the director of the United States Geological Survey to make this inventory for use in setting up a comprehensive plan "for developing both surface and ground waters for domestic and industrial supplies, irrigation, navigation, power and other uses and for the conservation and control of flood water." An appropriation of $400,000 is sought for the first year's work and $500,000 for each year for nineteen years thereafter.

The purpose of the bill is to expand the work of the water resources division of the Geological Survey and vest in that agency, among other things, the authority to make a general survey of the country's streams. An ineffectual effort was made at the last session to obtain legislation which would have enabled the Federal Power Commission to make such a survey, using license fees for the purpose. The Power Commission and the Corps of Engineers, however, were directed to report to Congress the cost of such a survey.

Committee at Work on Patent Office Improvement

The increase of the technical staff at the Patent Office at Washington by 100 is essential to placing the work there on a more satisfactory basis. A recommendation to that effect has been approved by the committee on Patent Office procedure. The proposal came originally from the sub-committee of engineers, composed of L. W. Wallace, W. H. Leffingwell and Wallace Clark, and was approved by the full committee. The sub-committee also recommended changes in the conduct of the work which will make possible a reduction in the clerical staff and an improvement in the quantity and quality of the work done. The full committee adopted practically all of the recommendations of the sub-committee.

An administrative assistant for the Commissioner of Patents is proposed which will make it possible for the commissioner and assistant commissioner to devote their entire time to their judicial duties. More attention to the classification division is urged. Thirty-five or forty additional examiners should be assigned to that work at once, the report says. Classification has been neglected because experienced examiners were not available. As a consequence, there has been no revision of the classification of many of the arts for forty years. The report shows that the present method of procedure is so involved and present equipment is so nearly obsolete that these drawbacks must be removed before improved conditions may be expected.

To Develop Chelan River

Washington Water Power Company Gets Site from Great Northern Road—Electrification Involved

CONFIRMATION of a reported agreement between the Washington Water Power Company of Spokane and the Great Northern Railway for the acquisition of the Chelan River power site in central Washington and its development in the very near future was obtained on Monday of this week from D. L. Huntington, president of the first-named company. Water rights were allotted by the state on August 29 for Lake Chelan, which is the natural reservoir for the Chelan River. This river is only a few miles long, but it will provide a head of more than 300 ft. for a power station to be built at its mouth near the Columbia River shore line. Upward of 100,000 hp. is available. Energy for the electrification of the Great Northern over the Cascade Mountains will undoubtedly be supplied from the new station. "The agreement with the Great Northern relative to the future acquisition of the Lake Chelan power site has been reached," said Mr. Huntington. "As a result the development of the Kettle Falls project will be postponed."

Electrochemists to Inspect Muscle Shoals

Members and guests attending the Chattanooga convention of the American Electrochemical Society will have an opportunity to leave Signal Mountain Hotel on the evening of September 25 and spend an entire day at Muscle Shoals inspecting the government's hydro-electric plant. The proceedings of the convention, which will begin on September 24, include a symposium on the fertilizer industry, for which ten papers have been received by the publication committee—"Manufacture of Sodium Nitrite by the Arc Process," "Development of Fertilizer Practice," "The Nitrogen Problem," "Development of Electrolytic Oxygen and Hydrogen Equipment," "Fixation of Atmospheric Nitrogen," "Hydrogen and By-product Oxygen in Relation to Nitrogen Fixation and Fertilizer," "Use and Preparation of Concentrated Fertilizers," "Development of Volatilization Methods for Manufacture of Phosphoric Acid," "Phenomena in the Electric Arc Process of Nitrogen Fixation" and "Electrochemical Phosphates."

Dr. H. C. Parmelee, editor *Chemical and Metallurgical Engineering*, will be in charge of this symposium. Robert Trumbull will be chairman of a round-table discussion on electric ferro alloys.

Iron and Steel Men to Hear Varied Papers

Three papers on the selection and maintenance of oil circuit breakers will be presented on Tuesday, September 15, before the twentieth annual convention of the Association of Iron and Steel Electrical Engineers, which will be in session at the Benjamin Franklin Hotel, Philadelphia, and the Philadelphia Commercial Museum from September 14 to 18. These papers will be presented by George A. Burnham of the Condit Electrical Manufacturing Company, M. J. Wohlgemuth and E. K. Reed, both of the Westinghouse company.

On Wednesday W. A. Powell and G. M. Albrecht of the Allis-Chalmers Manufacturing Company will deal with the use of direct-current armature windings for multipolar generators and motors. On Thursday E. A. Hurme of the Westinghouse company will discuss electric heat-treating furnace applications, J. A. Seede of the General Electric Company electric melting furnaces, and there will be a report on the electrically heated soaking pit in operation at the works of the Donner Steel Company. Auxiliaries and auxiliary drives for steam-electric generating stations will be the subject of a paper to be presented on Friday by A. L. Penniman, Jr., and F. W. Quarles of the Consolidated Gas, Electric Light & Power Company of Baltimore, and this will be followed by one on the extension of the heat cycle in boiler operation by the use of preheated air for combustion, of which J. G. Worker, vice-president American Engineering Company, Philadelphia, will be the author.

The usual manufacturers' exposition will be held in the Philadelphia Commercial Museum, and there will be sessions of the association's safety division, motion-picture lectures on radio, the Diesel engine and other topics, and a dinner-dance on Thursday evening.

Yuba River Conflict to Come Up Again

Federal Power Commission Will Hold Meeting to Reconsider Application of Nevada Irrigation District—Permits Sought in Florida—License for Chelan River Asked

THE application of the Nevada Irrigation District for power rights on the Yuba River is to be reconsidered by the Federal Power Commission at a meeting to be held for that purpose on September 15, when a decision between the conflicting applications of the irrigation district and the Yuba River Power Company will be sought. By the provisions of the irrigation district's application the Pacific Gas & Electric Company would be allowed to make use of the water before it was turned into the irrigation system. The irrigation district has a contract with the company which provides for the routing of one-third of the water through the Beer Creek plant of the company and the remainder through its Bear River plants. Provision also is made for temporary use of the water by the company at its Halsey and Wise power houses, with the right to use it in any plants that may be built in the future on Bear River. The contract calls for payment partly on an acre-foot basis and partly on the number of kilowatt-hours generated and the amount of water delivered. After the first twenty-five years payment is to be wholly on a kilowatt-hour basis. The rate is three-fourths of a mill per kilowatt-hour for all energy generated from district water in any plant of the company.

An analysis of the proposition submitted first indicated, in the opinion of the staff of the commission, that the returns from the sale of power would not carry a sufficient proportion of the interest and charges on the Milton diversion to make it practicable for the district lands to stand the cost of the development. This situation, however, has been modified considerably through redesign and consequent reduction in cost of storage and diversion works on the mountain division.

The East Tennessee Development Company has applied to the commission for a preliminary permit covering a project on the Tennessee, the Clinch and Powell Rivers, in Hamilton, Rhea, Meigs, Roane, Blount, Knox, Anderson and Claiborne Counties, Tenn. It is proposed to erect dams and power houses at eleven different sites, at which an aggregate of 444,500 kw. will eventually be installed.

Ernest L. Hill and C. Lyman Spencer of Jacksonville, Fla., have applied for preliminary permits covering five projects in Florida and southern Georgia which will develop an aggregate of 26,000 net ten-hour horsepower at low water during the average year. One and three-quarters miles above Bradford, Fla., on the Suwanee, a head of 35 ft. can be developed, the application states. Another dam and power house is planned for a site 4 miles east of White Springs, Fla., on the same river. A head of 66 ft. is available at that point. At Troders Hill, on the St. Mary's River, a head of 40 ft. is to be developed. At Trail Ridge a head of 61 ft. is available from waters drawn from Cedar Creek and the three prongs of the St. Mary's. Another stage of the development is to take place in the Okefenokee Swamp. The project there calls for low dikes with 6 miles of canal to the power house. In this way a head of 19 ft. can be made available.

The West Florida Company, at Tallahassee, has applied for a preliminary permit to cover a development on the Ocklocknee River near Quincy, Fla.

A license has been issued to the California Oregon Power Company of San Francisco covering a 34,000-volt transmission line to serve the Victory Gold Mines in the Klamath National Forest.

A license has been issued to the Washington Water Power Company of Spokane for a 110,000-volt transmission line, 163 miles long, from the company's Long Lake power house to its Brewster substation.

The Chelan Electric Company of Seattle has applied for a license covering a project on Chelan River and Chelan Lake, in Washington. It is proposed to construct a diversion and control dam in Chelan River, thereby giving Chelan Lake a reservoir capacity of 640,000 acre-feet. The project provides for two pipe lines 2 miles in length and a power house with five generator units. The primary power is estimated at 65,000 hp. and the secondary at 60,000 hp. The five turbines, however, will be rated at 125,000 hp.

Briefer News

Oregon Utility Begins New Transmission Line.—The Pacific Power & Light Company, Portland, has begun construction work on a 66-kv. transmission line extending from Pomeroy, Wash., to Clarkston, Wash., about 30 miles. Material has been delivered along the line and pole holes have been dug.

What Did Chippewa Falls Vote For?—The Wisconsin Railroad Commission has decided against the Northern States Power Company, which maintained that the people of Chippewa Falls voted last April to take over the gas as well as the electric system of the company, since the word "electric" did not appear on the ballot. The dispute had halted the valuation of the electric property, which will now continue.

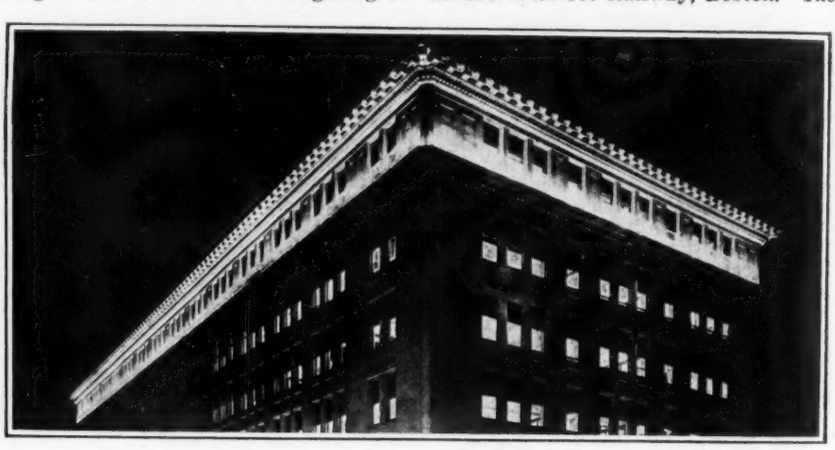
Wisconsin Valley Electric Company Acquires Waupaca Property.—The Wisconsin Valley Electric Company, which recently took over the independent plant at Antigo in that state, has also acquired the Waupaca Electric Service & Railway Company, which owns a small hydro-elecrtic plant, a steam plant and a distribution system. The steam plant will be discontinued and the hydro plant interconnected with the company's system, which now extends into eight counties in central Wisconsin.

Horse Mesa Dam to Provide 34,000 Kw.—Work on the excavation for the Horse Mesa dam of the Salt River Valley Water Users' Association is expected to be completed late in October. when pouring of the cement for the foundation will be started. January 1, 1926, is set as the date when the dam will be finished. This structure, which is being erected about 17 miles below the Roosevelt Dam, in Arizona, will be 300 ft. high and will impound 300,000 acre-ft. of water. The pioneer plant, in which three generating units will be installed, will have a capacity of 34,000 kw.

Oklahoma Power Company Routes Lines to Serve Farmers.—All electric transmission lines to be constructed in the future by the Oklahoma Power Company will be routed so as to serve the greatest number of farmers and will not be located with reference to hard-surfaced highways or the most direct line, according to announcement of C. H. Kretz of Okmulgee, vice-president of the company. This policy is being followed in the construction of a 13,200-volt transmission line being built from Okemah to Castle and Boley. Mr. Kretz announces that on the Boley line a model electrified farm is to be established. The farm will use more than 100 hp., the energy to be used for the operation of an irrigating pump, sweet-potato drying plant and various other activities. The Oklahoma Power Company recently obtained franchises for Castle and Boley and is now building the transmission line to serve these towns. A municipally owned electric light plant is being supplanted at Boley.

New Jersey Power & Light Puts 110,000-Volt Line in Operation.—A 110,000-volt, 17-mile transmission link between Holland, N. J., on the Delaware River, and Glen Gardne. in the same state, has been put into service by the New Jersey Power & Light Company, which, with headquarters at Dover, is one of the constituent companies making up the Barstow Pennsylvania-New Jersey system. The completion of this line permits the transmission to New Jersey of high-voltage power from the Easton, Reading and Middletown generating stations. The 33,000-volt transmission lines from Pennsylvania will, however, be retained, affording consumers in New Jersey a double system of power supply from west of the Delaware. The new line, which was started late last year, utilizes ninety-seven steel towers and cost more than $200,000.

Floodlighting Philadelphia Company's New Building in Pittsburgh.—A color floodlighting scheme is being used to enhance the attractiveness of the office and service building of the Philadelphia Company recently erected at Sixth Avenue and William Penn Way, Pittsburgh. This is the first floodlighting of any magnitude to be permanently employed in that city and is due to Floyd E. King, illuminating engineer with the Duquesne Light Company. The effect is obtained through the use of a specially designed copper housing containing more than 500 "Mazda C" lamps in mirrored-glass reflectors with colored glass lenses. A decorative copper crown supports and conceals the lighting equipment on the upper belt course of the building. From here the light floods the upper story and cornices, bringing out strongly the architectural details.



Irrigation and Power Projects for Southwest.—Plans for control of the floodwaters of the North and South Canadian Rivers, the Cimaron River and the Red River, including the reclamation by means of irrigation of vast bodies of land in Texas, New Mexico and Oklahoma, were discussed at a conference just held in Amarillo, Tex., by engineers and others interested. Dam sites at various points along these rivers have been inspected and surveys of the streams were recently completed under direction of the United States Reclamation Service. The tentative plans provide that the principal dam shall be constructed on the Canadian River near Logan, N. M. It would form a water-storage reservoir sufficient to irrigate 3,000,000 to 4,000,000 acres in New Mexico and the Texas Panhandle. The scheme would probably include a series of hydro-electric plants, and Irrigation Commissioner Stinnett of Texas is quoted as saying that General Goethals is investigating the practicability of building one or more large plants in the Panhandle territory and that Eastern capitalists are interested.

Taunton (Mass.) Municipal Plant May Purchase Energy.—Future development of central-station service supplied by the lighting department of the city of Taunton, Mass., is being studied with a view toward determining whether to enlarge the present steam generating plant or to purchase energy from outside companies. Proposals to supply electricity are now in preparation or have been submitted by the Union Light & Power Company, Franklin, Mass.; Narragansett Electric Lighting Company, Providence, R. I.; Edison Electric Illuminating Company of Brockton, Mass., and the Eastern Massachusetts Street Railway, Boston. The rapidly approaching completion of the initial installation of the Montaup Electric Company near Fall River, owned by the Fall River, Blackstone Valley and Brockton companies, has quickened interest in the situation.

Northern Pacific Railroad Electrifies Its Ventilating Fans in Stampede Tunnel.—A noteworthy application of electricity to railroad operations was recently made by the Puget Sound Power & Light Company, Seattle, when it installed electric service to drive the ventilating fans in the famous Stampede tunnel of the Northern Pacific Company in the Cascade Mountains, replacing an antiquated steam drive. The tunnel is 9,800 ft. long, and nineteen trains pass through it daily, so that the need for forced ventilation is apparent. Two large fans each driven by a 500-hp. motor, are installed at the western portal to blow the air eastward through the tunnel. The motors are manually controlled, and it is the practice to start the fans for westbound trains when the train enters the eastern portal and for eastbound trains when the train leaves the eastern portal. The fans are left running until the interior has been cleared of smoke

and gases. Service for the motors is supplied from the 110,000-volt transmission line of the Puget Sound company running from Seattle to Wenatchee, which passes near the Northern Pacific right-of-way at this point. A 1,500-kw. substation was installed to carry the service.

Rebuild Northern Idaho Line.—Reconstruction of 5¼ miles of 60,000-volt transmission line between Kellogg and Osborn, Idaho, in the Coeur d'Alene lead-silver-zinc mining district of the Idaho "Panhandle," is now under way under direction of the light and power department of the Washington Water Power Company. The line has been in service as No. 1 tie line for more than twenty years. It will be merged into the No. 2 tie line.

Newfoundland's New Hydro-Electric Plant Starts Up. — The hydro-electric plant built to serve the Armstrong-Whitworth pulp and paper mill at the mouth of the Humber River, Newfoundland, in the new town of Corner Brook, has been put into service. It has an ultimate rating of 225,000 hp. and the production of 400 tons of newsprint a day is promised. The entire industrial development began only two years ago with the cost guaranteed by the Newfoundland and British governments to the extent of $20,000,000. The waters of Grand Lake, 200 square miles in area, were diverted into Deer Lake and thence into the turbines of the power houses. High-tension transmission lines carry the energy to Corner Brook.

Plan to Increase Power Yield of Upper Mississippi at St. Paul. — St. Paul business men are advocating the further development of the upper Mississippi River by the construction of a single lock and dam near Prescott and leasing the power thus generated to the Ford Motor Company to supplement the power now derived by that company from the High Dam plant. A 20-ft. dam at Prescott would, it is said, generate more power than can be produced at the High Dam. It would form a large lake which would back up the St. Croix River beyond Stillwater and would make river transportation available to Stillwater as well as St. Paul. The cost of the Prescott project is estimated at about $4,000,000.

Massachusetts Institute of Technology Offers New Electrical Course.—Co-operating with the Bell Telephone System, the Massachusetts Institute of Technology this fall will offer a new course in electrical communications, combining the educational facilities of the institute with the industrial advantages of the Western Electric Company, the New York Telephone Company and the Bell Telephone Laboratories for professional training. The first two years of the course will be given at the institute, and in the three succeeding years students will divide their time equally between instruction at the institute and practical training in plants of the co-operating companies. The final year will consist of graduate work in electrical engineering.

Stone & Webster Take Over a Texas Plant.—It is announced by George H. Clifford, district manager for the Stone & Webster interests in Texas and Louisiana, that the Eastern Texas Electrical Company of Beaumont, one of the Stone & Webster subsidiaries, has purchased a controlling interest in the Western Public Service Company. The transaction involved a consideration of more than $1,000,000, Mr. Clifford said. The properties taken over are the electric light, water and ice plants at Alvin, Dayton, Cleveland, Calvert, Navasota and Somerville; electric light and ice plants at Kosse, Conroe, Sour Lake, Liberty, Huntsville, Groveton, Trinity, Hempstead and Caldwell; electric light plants at Anderson, Lyons and Bremond; ice plants at Bryan and Hearne; electric power and distribution plants at Hull and Daisette. It is planned to bring these several electric plants ultimately under a general power distribution system.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 4, page 50.]

Camp Co-operation V (local leagues)—Association Island, Henderson Harbor, N. Y., Sept. 8-12. (Society for Electrical Development, New York, is sponsor.)

New England Division, N. E. L. A.—Hotel Griswold, New London, Conn., Sept. 8-11. Miss O. A. Bursiel, 149 Tremont St., Boston.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 9-12. Harold A. Buch, 212 Locust St., Harrisburg, Pa.

Pennsylvania State Association of Electrical Contractors and Dealers—Hotel Jermyn, Scranton, Sept. 10. M. G. Sellers, 1202 Locust St., Philadelphia.

Rocky Mountain Division, N. E. L. A.—Hotel Colorado, Glenwood Springs, Col., Sept. 14-17. O. A. Weller, 900 15th St., Denver.

Illuminating Engineering Society—Hotel Statler, Detroit, Sept. 14-18. N. D. Macdonald, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Benjamin Franklin Hotel, Philadelphia, Sept. 14-19. John F. Kelly, Empire Bldg., Pittsburgh.

American Institute of Electrical Engineers, Pacific Coast Section—Olympic Hotel, Seattle, Sept. 15-18. F. L. Hutchinson, 33 West 39th St., New York.

Great Lakes Geographic Division, N. E. L. A.—French Lick Springs, Ind., Sept. 23-26. R. V. Prather, 305 Illinois Mine Workers' Bldg., Springfield, Ill.

Association of Electragists International—West Baden, Ind., Sept. 23-25. L. W. Davis, 15 West 37th St., New York.

American Electrochemical Society—Chattanooga, Tenn., Sept. 24-26. Colin G. Fink, Columbia University, New York.

Pacific Coast Supply Jobbers—Hotel Del Monte, Del Monte, Cal., Sept. 24-26. A. H. Elliot.

Empire State Gas and Electric Association—Lake Placid Club, N. Y., Oct. 1-2. C. H. B. Chapin, Grand Central Terminal, New York.

American Electric Railway Association—Atlantic City, N. J., Oct. 5-9. J. W. Welsh, 292 Madison Ave., New York.

National Association of Railroad and Utilities Commissioners — Washington, D. C., Oct. 13-16. J. B. Walker, 270 Madison Ave., New York.

Electric Power Club—Briarcliff Manor, N. Y., Oct. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Association of Edison Electric Illuminating Companies — Hot Springs, Ark., Oct. 19-23. Preston S. Millar, 80th St. and East End Ave., New York.

Association of Railway Electrical Engineers—Hotel Sherman, Chicago, Oct. 20-24. J. A. Andreucetti, 413 C. & N. W. Terminal Station, Chicago.

American Welding Society—Boston, Oct. 21-23. M. M. Kelly, 29 West 39th St., New York.

Kansas Public Service Association—Topeka, Oct. 23-24. H. Lee Jones, Topeka, Kan.

Iowa State Association of Electrical Contractors and Dealers—Waterloo, Iowa, Oct. 27.

Southeastern Geographic Division, N. E. L. A.—Chattanooga, Tenn., Oct. 29-30. E. T. O'Connell, Alabama Power Co., Birmingham.

Inductive Interference to Be Discussed by Oklahoma Utilities Men.—The electric light and power division of the Oklahoma Utilities Association will hold a district convention at Frederick September 16, and the telephone division will have a district meeting on the following day at Hollis. Problems connected with inductive and radio electrical interference will be discussed at both meetings, in the interest of greater co-operation.

Industrial Heating School in Cleveland.—The East Central Division of the National Electric Light Association, in co-operation with the national committee and the Westinghouse Electric & Manufacturing Company, will conduct a three-day industrial heating school in Cleveland on September 14, 15 and 16. C. G. Eichelberger, Union Gas & Electric Company, Cincinnati, is chairman of the school. In accordance with the policy of the national committee on industrial heating, the geographic division schools are being conducted by the Westinghouse Electric & Manufacturing Company and the national schools are being conducted at the factories of the General Electric Company. Those enrolled in the Cleveland school will have the advantage of attending the convention of the American Society for Steel Treating to be held in that city during the week of September 14.

North Central Electric Association Holds Meeting in South Dakota.—The third of a series of eleven meetings which the North Central Division of the N. E. L. A. will hold in Minnesota and North and South Dakota took place August 18 at Huron, S. D., with the Northwestern Public Service Company of that city as host. The central station companies and contractor-dealers of that region were invited to an afternoon session, and local problems were discussed around the table, John W. Lapham, executive secretary of the division, presiding. Mrs. Ruth Gage Thompson of Minneapolis, chairman of the women's public information committee for the division, conducted a woman's meeting. About forty-five men and twenty-five women participated in the deliberations. J. A. Ward, general manager Northwestern Public Service Company, was toastmaster at an evening banquet. Previous meetings of the division have been held at Albert Lea, Minn., and Bismarck, N. D.

Men of the Industry

C. D. Parker Managerial Changes

Edward D. Hamblen, manager of the Union Light & Power Company, Franklin, Mass., has been appointed manager of the Central Massachusetts Electric Company, with headquarters at Palmer, Mass., succeeding H. M. Parsons, who has joined the sales and development organization of Landers, Frary & Clark, New Britain, Conn. Mr. Hamblen's successor at Franklin is Louis A. Fiorani, formerly sales manager of the Union company. These three men have been prominent in the utilities under the management of C. D. Parker & Company, Boston, and have been active in the New England Division of the N. E. L. A., Messrs. Hamblen and Fiorani having been chairmen of the Commercial Section and Appliance Bureau respectively and Mr. Parsons chairman for several years of the committee on rural line extensions.

E. R. Meacham, who has been supervising the development of the experimental farm line served by the Wisconsin Power & Light Company at Ripon, has been named manager of the company's new rural service department with headquarters at Madison. Electrical problems affecting the farmer will be handled by this new department.

W. T. Bracken, for the last five years commercial manager in charge of the service and merchandising departments of the Beloit Water, Gas & Electric Company, which were organized and successfully developed by him, has resigned from that position to join the Kewanee Public Service Company, Kewanee, Ill.

J. F. Fraser of Halifax, Nova Scotia, has been appointed chairman of the Nova Scotia Power Commission to succeed E. H. Armstrong, ex-Premier of the province.

V. W. Berry has been appointed assistant to the vice-president and general manager of the Virginia Railway & Power Company, Richmond, Va., which recently was acquired by Stone & Webster, Inc., Boston. Mr. Berry has been connected with the Stone & Webster interests in Texas since 1906.

B. T. Taylor, formerly connected with the Union City (Ohio) Electric Company, has been appointed manager of the Miami Valley Electric Company, De Graff, Ohio, to succeed L. L. Stahler, recently transferred to the Union City utility. Both these properties are operated by the Albert Emanuel Company, Inc.

Fred J. Bollmeyer has been appointed director of the Ohio Committee on Public Utility Information, Cleveland, to succeed Benjamin E. Ling, resigned. Mr. Bollmeyer has long been engaged in newspaper work and for the past year and a half has been identified with the committee as associate director.

R. G. Sloat has severed his connection with the Alliance office of the Ohio Public Service Company to become chief electrical engineer of the Hinde & Dauch Paper Company, whose headquarters are at Sandusky. Mr. Sloat became identified with the Public Service Company a year ago, when it took over the properties of the Sandusky Gas & Electric Company, with which he had been affiliated since 1900. Starting as an oiler in the power plant, he advanced by various steps to be in charge of operating and distribution of the Sandusky utility. Recently he was transferred to Alliance and placed in charge of the distribution system.

C. M. Breitinger New Chairman of Accounting National Section

C. M. Breitinger, who has been appointed chairman of the Accounting National Section of the National Electric Light Association, as announced in the August 22 issue of the ELECTRICAL WORLD, has been affiliated with the

C. M. BREITINGER

Philadelphia Electric Company since 1916. In that year he entered the controller's department of the company, and to him has since been assigned the responsibility of the statistical division in that organization. A native of Philadelphia, Mr. Breitinger received his education at the Pennsylvania State College and the University of Pennsylvania. Following graduation he was employed as student engineer with the Allis-Chalmers Manufacturing Company, Milwaukee, and later became identified with D. C. and William B. Jackson, consulting engineers in Chicago, in valuation and public utility management affairs.

He has been actively engaged in association work for several years in both the Pennsylvania Electric Association and the National Electric Light Association, having been chairman of the committee which formulated the system under which fixed-capital records may be compiled and maintained, chairman of the accounting sub-committee on joint-pole use and chairman of the committee on co-ordinating geographic and National Accounting Section activities, under whose plan the Accounting Section will function during the present association year.

C. E. Moody, formerly connected with the Lineville (Ala.) office of the Alabama Power Company, has been appointed local manager in Jacksonville, Ala.

L. T. Stone, for the past nineteen years in the employ of the Southern California Edison Company, Los Angeles, has been appointed district manager in Tulare.

Edwin R. Martin, assistant professor of electric power engineering at the University of Minnesota, has resigned in order to enter the industrial power division of the Westinghouse Electric & Manufacturing Company at East Pittsburgh.

H. H. Allison, formerly connected with the Electric Appliance Company of San Francisco, has recently affiliated himself with the general offices of the Great Western Power Company of California.

David Moffat Myers, consulting engineer, is continuing his practice as consultant in industrial power-plant design and operation with offices in New York. The former partnership of Griggs & Myers has been dissolved by mutual consent.

W. W. Boettcher, who has been connected for the past three years with the Wisconsin Valley Electric Company's electric and gas properties at Stevens Point, has been named to succeed Ralph B. Lillie as manager of the company's properties at Tomahawk, following the transfer of Mr. Lillie to Antigo.

L. L. Stahler, manager of the Miami Valley Electric Company, De Graff, Ohio, has been transferred in the same capacity to the Union City (Ohio) Electric Company. Both these properties are operated by the Albert Emanuel Company, Inc.

Franklin C. Eteson, illuminating engineer of the Blackstone Valley Gas & Electric Company, Pawtucket, R. I., has been appointed sales manager of the Keokuk (Iowa) Electric Company. Mr. Eteson was winner of the Frank W. Smith prize for 1925 and was recently appointed chairman of the Lighting Bureau of the Commercial Section, New England Division, National Electric Light Association.

John W. Otterson, for the past three years a member of the editorial staff of the *Journal of Electricity,* a McGraw-Hill publication, has been appointed to the position of business manager to fill the vacancy caused by the resignation of Curtis M. Lindsay. Mr. Otterson's work on the editorial staff has been largely connected with the merchandising branch of the electrical industry.

E. C. Magruder, sales specialist for the Meadows Manufacturing Company of Bloomington, Ill., is now in San Francisco, where he will co-operate with jobbers and dealers in their sales plans. Mr. Magruder, who has spent twenty-seven years in the field of electrical appliance merchandising, travels all over the United States in connection with his work of building up sales plans for jobbers and dealers, creating new sales plans and ideas and actively supervising their execution.

Charles L. Leighton, who was formerly connected with the Fort Smith (Ark.) Light & Traction Company as manager of the commercial department, has been appointed superintendent of public utilities of the city of Braman, Okla. For four years previous to his association with the Arkansas utility Mr. Leighton was manager of the Minnesota Electric Light & Power Company at Cushing, Okla.

William A. Cyr, formerly connected with the San Diego Consolidated Gas & Electric Company, has joined the staff of the *Journal of Electricity*, to succeed as associate editor John W. Otterson, who has been promoted to the position of business manager. During the three years Mr. Cyr has been identified with the San Diego utility he has edited the company publication, acting at the same time as San Diego correspondent for the *Journal of Electricity*.

A. B. Hendry, secretary of publicity for the St. Louis Chamber of Commerce, has resigned to become advertising and publicity director for the Union Electric Light & Power Company of that city. Mr. Hendry succeeds William F. Allen. He is a former newspaper man and was connected with the Chamber of Commerce for three years. In addition to directing its publicity department he acted as editor of *Greater St. Louis*, the official publication of the chamber.

C. E. Olaison of Minneapolis is now associated with the Oklahoma High Line Construction Company, Tulsa, Okla.

E. K. Hartzel of the publicity department of the Public Service Company of Colorado, at its Boulder headquarters, has been named assistant publicity director and will help Frank R. Jamison, who was recently named director of publicity. Like Mr. Jamison, Mr. Hartzel is a newspaper man of broad experience, having for years been connected with various newspapers in Illinois.

Obituary

William H. Outtrim, head of the stationary motors department of the River Works of the General Electric Company at Lynn, Mass., died at his home in Swampscott August 17 at the age of sixty-one. He had been employed by the company for more than forty years.

Joseph Mayo, pioneer in electrical power development in California, died suddenly in Berkeley, August 4. Mr. Mayo settled in California forty years ago and was identified with electrical projects in Healdsburg, Crockett and Martinez.

Terrence H. Foley, general manager of the Bend (Ore.) Water, Light & Power Company, died August 16 as the result of injuries received in an automobile accident. Mr. Foley was born in Newfoundland in 1879. Fifteen years ago he went to Bend from Fairbanks, Alaska, and was first employed by the Bend Water, Light & Power Company as lineman.

Commission Rulings

Amortization of Abandoned Property.—In fixing a valuation for the Rockford Electric Company an item entitled "amortization of abandoned property," included in the company's exhibit, was specifically commented on by the engineer of the Illinois Commerce Commission. It appeared that in various rebuildings of this property which had taken place almost continuously from the year 1908 up to the time of the commission hearing equipment had been removed from the plant and replaced by units which operate at a higher efficiency and produce a kilowatt-hour of energy at much lower cost. The units thus abandoned had not reached the end of their useful lives but had merely become obsolescent. The replacement of these units by those of a greater efficiency was an economic benefit because, even though a fund was not available by which to retire these units from capital account, the new units are able to generate electrical energy at a sufficient saving over the old units to enable the remaining value of the old units to be amortized through operating expenses and at the same time show a reduction in operating expenses. The company, wishing to retire within ten years the entire cost of the property first abandoned, was charging approximately $30,000 a year to operating expense with that object. This practice began in 1920, when the company had no retirement reserve, and had been continued in the case of other property later abandoned. While permitting the original amortization to be completed, the commission ruled that all subsequent amounts must always be charged to the retirement reserve which had been subsequently set up.

Adjudication of Conflicting Petitions and Reasons for Judgment.—Conflicting franchises held by Fred W. Young and the Niagara, Lockport & Ontario Power Company respectively led to the following decisions by the New York Public Service Commission: The petition of Young to exercise franchises in the towns of Randolph, Cold Springs, East Otto, Little Valley and Napoli, in Cattaraugus County, granted by the towns several years ago and never exercised, was denied, with the privilege of renewing the petition with respect to Napoli when sufficient demand for electric service shall warrant. The petition of the Niagara company for authority to serve the town of Randolph, the westerly portion of the town of Perrysburg and the town of Cold Spring was granted, but the commission denied its petition to serve the town of Leon and the village of Perrysburg, now being served by the Young interests. The Niagara petition to serve the villages of Randolph and East Randolph also was denied, the Young interests being engaged in rebuilding the distribution system in those villages and having lowered the rates. The commission said that the Young plant, now controlled by the Associated Gas & Electric Company, had made no effort in recent years to exercise franchises which it held in the several towns and that there have been frequent complants as to its service and rates. Little Valley and East Otto had canceled its franchises. The Niagara company, which succeeded to franchise rights of the Cattaraugus Electric Light & Power Company in the town of East Otto, is now engaged in extending its system into that town and the municipal plant of Little Valley has received permission to extend its service. While criticising the action of the Young interests in rushing construction work to serve the village of Perrysburg and town of Leon after these municipalities had granted franchises to the Niagara company and while approval was pending, the commission held that two services are not required in these localities.

Recent Court Decisions

Non-Operative Property Rightly Excluded from Valuation, and Commission the Proper Judge.—The Boise Artesian Water Company in an action to set aside the valuation of its property for rate-making purposes by the Idaho Public Utilities Commission complained of the action of the commission in refusing to include the value of a steam pumping plant in the total value of its property. The historical cost of the steam pumping plant was given as $12,792, and its reproduction cost was estimated to be $20,796. The steam pumping plant was installed in 1895 and was used by the company in pumping water through its system until 1907, when an electric pumping plant was installed. The evidence showed that the pumping of water by electricity is more economical. The commission found that the steam pumping plant "was not reasonably necessary to assure a power supply, or to assure an adequate pumping plant, or to guard against the effect of unusual high water upon the electric pumping plant, and that the steam plant is in fact non-operative property." This contention has been sustained by the Idaho Supreme Court, which says: "Whether the steam plant was non-operative property was purely a question of fact. We conclude that the finding of the commission is supported by the evidence. Where the evidence shows that property is non-operative, it surely cannot be the law that the commission must include the value of such property with that which is used and useful because to do otherwise would constitute an interference with the managerial functions of the company. Whatever powers or functions may be possessed by the owners or managers of a utility which may not be interfered with by a commission, users cannot be required to pay a return on property which the commission has found on sufficient evidence is non-operative. To hold otherwise would make a farce of utility regulation." (236 Pac. 525.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

No Patent Infringement in Boiler Suit

United States District Judge Makes Interesting Decision of Babcock & Wilcox Against Springfield Boiler Company and Superheater Company

A COURT decision on technical matters is usually a brief, dry document, but in a decision handed down by Judge D. J. Knox of the United States District Court for New York on August 26 some very interesting comments are made. This case came about in connection with the boiler installation for the Hell Gate station of the United Electric Light & Power Company, New York. The Springfield Boiler Company, Springfield, Ill., and the Superheater Company, New York, made the installation, and in so doing it was claimed by the Babcock & Wilcox Company that patents owned by that company were infringed.

The alleged infringing boiler is of the double-stoking, horizontal type. It has two banks of water tubes, one below and one above a superheater composed of bent tubes which extend transversely to the water tubes. The judge held that the boiler is of a construction that may bring it within the reading of the claims of the Pratt patent and if a liberal interpretation is given of the Bell patent, but declared that the question as to whether such readings should be made necessitated reference to the development of the boiler art of the present day. The court then proceeded to survey boiler-plant developments and pointed out that what had been accomplished seemed to have come to pass without assistance from either of the patents in suit. In other words, no boiler manufactured in accordance with the principles of either invention was put into commercial use before the installation that was held to constitute infringement. The practical step in advance was, in the opinion of the court, made by the defendants. The court also held that no testimony offered at the trial tended to support the charge that the defendants had copied the design of the Hell Gate boiler from the plans and specifications attached to the plaintiff's bill.

The court also discussed Pratt's claims on superheater construction and location, stating that "it seems to be going a long distance to give him domination over the future development of an important art, merely because he was fortunate enough to get allowed certain claims that are broader than his disclosures." The effect of baffling and its connection with the superheater and boiler design as affecting patent claims was also discussed by the court, and technical interpretation was given to the words "pass" and "baffle." In its conclusion, as reported in the August 29 issue of the ELECTRICAL WORLD (page 439), the court held that there was no infringement.

In rendering his decision the Judge said: "The net result of my examination of the facts in this case is that defendants have constructed a type of superheater water-tube boiler that differs materially from those shown and claimed by the patents in suit, and that it is accomplishing results which, if they were contemplated by Pratt and Bell, are brought about by a construction that avoids any valid claim of infringement of the patents granted upon their inventions. It follows that the complaint must be dismissed." The finding is unusual in that the judge reasons from the standpoint of technical and practical developments in the art rather than dismissing all items excepting the detailed patent claims. The case may be appealed.

The Long View in Advertising

Edison Lamp Works Initiates Campaign to Better Central-Station Public Relations— Federal Electric Campaign Advertises Electrical Advertising

TWO interesting examples of taking the long view in advertising are attracting the attention of the electrical industry right now. The Edison Lamp Works of the General Electric Company are responsible for one, the Federal Electric Company for the other. In the first case the manufacturer has developed a very complete presentation of the relationship between the central

Where there is light-there is life
HOTEL
SINTON
ONCE upon a time, it was an adventure to journey a hundred miles: a subject for interested friendly gossip and long preparation. That was when horse, stage and "shank's mare" were the principal means for travel.
Now we travel twice as far between breakfast and luncheon—just as a matter of course.
Motorists and travellers are abroad in the land—"gypsying" or on business bent. "Where is a good hotel?" "Where a good restaurant?" "Where is this and where is that?"
The old town has combed its hair and spruced up to welcome the many strangers within its gates.
Hospitality must be expressed and assured. So the modern tavern and busy shop invokes the magic of light to point the way by night and day; to beckon a cheerful welcome.
What is more natural than that the wayfarer should respond to this cordial greeting. Most people like kindred company—activity and life. Where there is light, there is life—and the radiant business emblem is the indication.
Owners of retail stores or manufacturing plants, who have not had called to their attention the advantages and economy of electrical advertising, may quickly obtain full information by calling up the nearest lighting company. This type of service has been remarkably developed to keep pace with the service furnished for other purposes. Many of the electric companies will not only arrange to provide a suitable individual display, but will also arrange to maintain the display with fresh lamps, keeping it bright and clean, to supply electricity at very low prices and to take care of the taxes and insurance. After your order is placed no further thought need be given. Your only cost for all this is an original partial investment and a nominal monthly service charge.
Full information is supplied to interested people by any of the well known electric lighting companies
BALTIMORE, MD. Consolidated Gas, Electric Light & Power Co.
CHICAGO, ILL. Commonwealth Edison Co.
CINCINNATI, OHIO The Union Gas & Electric Co.
KANSAS CITY, MO. Kansas City Power & Light Company
MILWAUKEE, WIS. The Milwaukee Electric Railway & Light Co.
MINNEAPOLIS, MINN. Northern States Power Co.
NEW ORLEANS, LA. New Orleans Public Service, Inc.
NEW YORK, N. Y. The New York Edison Co.
NEW YORK, N. Y. Brooklyn Edison Co.
The United Electric Light & Power Co.
New York & Queens Electric Light & Power Co.
OKLAHOMA CITY, OKLA. Oklahoma Gas & Electric Co.
PHILADELPHIA, PA. The Philadelphia Electric Co.
ST. PAUL, MINN. Northern States Power Co.
SAN DIEGO, CAL. San Diego Consolidated Gas & Electric Co.
PUEBLO, COLO. Southern Colorado Power Co.
STOCKTON, CAL. Western States Gas & Electric Co.
SALINAS, CAL. Coast Valleys Gas & Electric Co.
"AN ELECTRIC SIGN IS NO BETTER THAN THE SERVICE IT GETS"

SAMPLE OF MANUFACTURER'S ADVERTISING APPEARING IN SATURDAY EVENING POST

station, who is his customer, and the public, who are the customers of the power companies, not only as concerns their attitude toward light, but primarily to advance a broader conception of the central station's approach to its market. The Federal company's contribution has been a national advertising campaign in the *Saturday Evening Post* to sell the idea of electrical advertising in the names of a group of electric power companies. In both instances the purpose is to promote the general market by developing a greater acceptance on the part of consumers of the service idea behind the product, as advertising men put it, without any direct sales appeal that would lead back to the manufacturer.

The Edison Lamp Works have issued an elaborate portfolio which revolves around the basic thought that the general public today thinks of electric service in the home in terms of light. They speak of the "light bill," no matter how many labor-saving appliances may be in use, and light bears the brunt when a "light bill" is under criticism. Obviously this not only reacts on light but make the entire service which the public utility offers seem high in cost, whereas if the customer thought naturally of the group of services that the current bill actually covers, it would seem less high. This thought is worked out in detail and the logic of it capitalized in definite suggestions as to how all the points of contact between the utility and the householder may be made to co-ordinate in supporting the idea—meter readers, complaint adjusters, cashiers, salesmen, correspondence, window displays and the rest. Even the monthly bill is recast so that it reads: "For service which made possible the comfort and convenience of electric light and your many electrical servants from ——— to ——— etc."—a "humanized bill." A large number of folders, meter-reading cards, newspaper advertisements and articles, poster stamps, window ideas and practical aids to the interpretation of this general method of approach are provided. Among the folders are some exceedingly clever side lights on the popular misconceptions of the cost of light. These folders are being furnished to companies that wish to carry out the program suggested in the portfolio. It is a long shot for direct advertising returns, but any influence it may have is naturally bound to benefit the sale of lamps at the same time it is improving public relations and promoting appliance sales.

ADVERTISING ADVERTISING

The Federal Electric Company's campaign consists of a series of full-page displays in the *Saturday Evening Post* which began in June and runs once a month. As the picture shows, they take the form of a straight message for electric sign advertising. The "ad" is signed not with the name of the manufacturer but by eighteen electric light and power companies scattered through some fifteen cities in which the Federal Electric Company operates a sign service. No mention is made in these advertisements of Federal signs. The central-station companies whose names are signed are contributing toward the cost of these advertisements. The copy refers the reader to any of these companies or to the local electric service company in any town, all of which have been fully advised of the campaign and the opportunity it offers to them to tie in in any locality where the *Saturday Evening Post* advertisements are read and interest aroused. Meanwhile reprints of these "ads" are being sent out to a large list of prospective customers. In addition, the Federal Electric Company is running a quarter-page "ad" on the page opposite the larger display on four of the insertions.

Electric sign advertising is one of the oldest applications of central-station service. Perhaps because of this it has been given but scant attention of recent years by the average power company, and there is a great dormant market waiting to be sold. This kind of a co-operative campaign will undoubtedly benefit all sign manufacturers, although the Federal company's communications with the local utilities will give it the advantage to which it is entitled for having initiated it. It is long-shot advertising, nevertheless, and shows a commendably broad policy—a willingness to build the market for the common good—that deserves reward.

Proposed New Wiring Method

Tentative Specifications for Non-Metallic Sheathed Cable Issued for Study by Electrical Industry

TENTATIVE specifications for non-metallic sheathed cable have been drawn up by the staff of the Underwriters' Laboratories and reviewed by the membership of the Underwriters' Laboratories Electrical Council. These specifications are now available for study and use by the electrical industry and others interested. They have been the outcome of a necessary step in the procedure implied in the action of the electrical committee of the National Fire Protection Association at its annual meeting in February, 1925. They are tentative and are subject to addition or other change as experience or study may suggest.

The Underwriters' Laboratories in a statement issued with the specifications says: "Those who may study these tentative requirements should bear in mind the status of the projected recognition of such a material and wiring method as regards the National Electrical Code, the sectional electrical committee and the Underwriters' Laboratories. This appears to be as follows: The wiring method involved in the use of non-metallic sheathed cable is not a method having present recognition in the National Electrical Code (including the forthcoming 1925 edition). The electrical committee of the N. F. P. A. has asked its standing committee on Article 5 (wiring methods) and the Underwriters' Laboratories to co-operate in the study of proposed recognition of use of a wiring method involving non-metallic sheathed cables and to submit a report to the next annual meeting of the committee. This report may or may not recommend recognition of such a method, and, whatever its nature, may be indorsed or rejected in whole or in part by the electrical committee. The findings of the Underwriters' Laboratories with respect to materials reviewed under the tentative requirements will be released pending action by the electrical committee on a report from the committee on Article 5 and constitute one phase of the co-operation requested of the Underwriters' Laboratories in the resolution of the February, 1925, meeting."

Business Conditions

IMPROVED business with the approaching fall continues to be reflected in the reports from various sections of the country. The attitude of electrical manufacturers is one of optimism, and from all sides comes the report that the volume of sales all summer has held up remarkably well. The number of inquiries in the market presages an increasing volume of business for the rest of the year. A few good orders were placed by central-station companies in various sections, one order covering large power-plant equipment in the East. There is an active demand for street-lighting equipment and many new installations are projected or under way. Motor sales are good and are holding up well. Motor manufacturers state that sales are ahead of those for last year, and the demand bids fair to continue good.

In New England a quickening trend in sales is noted, with an active demand for most kinds of electrical supplies and equipment. Street-lighting equipment is selling well in that territory. Sales to industrial plants in the New York district continue steady and are holding up well. Orders from central-station companies in that section include a large order for power-house equipment with many smaller orders in good volume. In the Southeast the volume of line construction work is creating a satisfactory demand for construction materials and business in all lines of trade has improved. The outlook is improving in the Middle West and purchasing by central-station companies is in good volume. On the Pacific Coast good business is reported but without spectacular orders.

Electric Sign Makers Report Large Sales in Northeast

HEAVY business in electric signs extending well into the fall is forecast by leading manufacturers in the Northeast. One house has placed contracts for 2,500 signs in New England alone, and the demand for theatrical, billboard and interior installations is growing by leaps and bounds. Recent installations of large

outdoor vertical signs for theatrical use include units from 46 ft. to 52 ft. long, and there is an active sale in progress of direction signs for use in hotels, public buildings, stores and other establishments. Moving signs for pictorial effects are coming into wider use for window and lobby applications. Increasing interest is apparent in maintenance clauses in sign contracts in order to insure continuity of display and pleasing service. One company has 125 such contracts in effect today.

Non-Ferrous Metal Markets Dull —Prices Decline Slightly

THE principal non-ferrous metal markets have been very dull during the week. Dealers and speculative traders, rather than producers, dominated the markets. A good volume of copper was sold at 14⅝ cents on Wednesday, but the gross sales for the week are measurably less than the comparatively low record of last week. The tin market is dull here and abroad.

NEW YORK METAL MARKET PRICES

	Aug. 25, 1925 Cents per Pound	Sept. 2, 1925 Cents per Pound
Copper, electrolytic	14.75	14.625
Lead, Am. S. & R. price	9.50	9.50
Antimony	17–17½	16½–17½
Nickel, ingot	33–34	33–34
Zinc, spot	8.075	7.925
Tin, Straits	57.50	56.625
Aluminum, 99 per cent	28	28

Base copper price Sept. 2, 1925, 16½ cents

With one or two exceptions copper producers are not in the market at the prevailing figure of 14⅝ cents. Some copper was sold last week Thursday at 14⅝ cents, but since then consumers have been able to get what they wanted at a materially lower figure, sales being made on Monday at as low a figure as 14.55 cents delivered. These were in comparatively small tonnages, being resale lots for the most part. The American Smelting & Refining Company has maintained its official contract price for lead at 9.50 cents all week. Some small sales of premium metal were recorded, but the requirements for spot metal are not urgent. Sales of zinc were in fair volume all week, wire makers being important buyers, though the brass founders were by no means out of the market.

Electrical Equipment Active in New England District

MANUFACTURERS and jobbers report a quickening trend in sales throughout New England during the past week, with the demand quite active in most kinds of electrical supplies and equipment. General wiring supplies are selling in good volume, with wire, conduit, pipe and hardware particularly strong features in the electrical market. Fixtures for both industrial and domestic uses are also in brisk demand. Reflectors are selling well and lamp stocks are being replenished. Industrial electric supplies are in good demand. Small motors are commanding a stronger interest, and one prominent manufacturer reports a shortage in production. Power equipment and control for electric elevators is receiving considerable attention, and many installations are under way, with a number of large projects pending.

The demand for watt-hour meters is noticeably stronger in outlying districts where line extensions have been in progress. Transformer sales are spotty, though one manufacturer records several encouraging orders during the past week. Electric recording instruments, on the other hand, are attracting much interest. Business in this field of equipment is reported to be far in excess over that for the same period last year. Street lighting is active, and many orders have been received by a leading manufacturer. The city of Lawrence, Mass., has recently placed an order for installing new street-lighting equipment. Several important equipment contracts are pending in the territory. Two large hotels have started construction; bids are open for a large hydro-electric contract, and power contracts in outside territory are being considered by local manufacturers. The New England Telephone & Telegraph Company plans to expend $2,080,585 in new construction during the coming year. Industrial heating continues to give promise of encouraging fall months as many inquiries and negotiations are under way. Domestic electric ranges are moving well, as reported by one leading manufacturer, with the demand in the Southern and Western States holding up well in quantity and regularity.

Good Business on Pacific Coast with No Spectacular Orders

BUSINESS has continued good on the Pacific Coast, but without spectacular features. Power company buying has been quiet, although orders for three carloads of 35-ft. poles and 10,000 pieces of pole-line hardware are reported from the Bay district and for a two-thousand-dollar assortment of conduit, weatherproof wire and 3,000-watt heaters from Fresno. Railroad buying has included 75,000 lb. of No. 6 and No. 8 bare iron wire and 40,000 ft. ⅜-in. Siemens-Martin strand. Miscellaneous supply orders from contractors, while not extraordinary large, are in very good quantities. For example, orders covering 10,000 ft. of No. 18 test three-conductor telephone wire, 150 assorted steel reflectors and many two-hundred-and-fifty-dollar assortments of schedule wiring devices have been placed. The cheaper convenience outlets and toggle switches are moving especially well. One manufacturer reports that he is selling five toggle switches to every push switch, whereas last year the sales ran nearly even.

Vigorous selling campaigns on such diverse lines as metal molding and electrical hollow ware insure a good finish to the year's business, the last five months of which will apparently surpass the sales of the first seven. The outstanding feature of the past week has been the appliance business. Jobbers report several orders, as one for fifty irons and 500 radiators, another for twelve vacuum sweepers, another for one-half gross curling irons and the like. Prices in rigid-iron conduit boxes and fittings have decreased about 10 per cent. Rubber-covered wire is stronger. The city of Seattle will soon award contracts for a considerable amount of 600-volt rubber-covered wire for extension work on which bids have been opened. Announcement has been made of the closing of options on the hydro-electric site by the Lake Chelan Power Company, a subsidiary of the Great Northern Railway.

Steady Flow of Business in the New York District

MANY small orders were placed in the New York district by central-station companies calling for metering and distribution equipment. Many items were for shipment to Southeastern properties. One large order was also reported covering power-house equipment. Several orders and inquiries have been placed by a mining company for electrical and other equipment for its South American properties. Wire sales have been in fair volume, with orders spotty but ahead of last year and competition still very keen.

Jobbers report a fair volume of business, and they say that the majority of their salesmen find that their customers are looking forward to a busy period for the rest of the year. The main demand is for conduit and conduit fittings, with a fair movement of wire, safety switches and fuses. Appliances are moving slowly. The Public Service Electric & Gas Company of New Jersey announces that the sales of electrical energy for the first six months of 1925 exceed those of the corresponding period of 1924 by 21 per cent, the demand for power purposes being largely responsible for the better showing. During this period the company reports that 37,622 electric motors were added to its line, making a total of 563,200 in service on July 1.

Line Construction Active in Southeast—Business Improves

THE near approach of fall is reflected in improved business conditions in all lines of trade in the Southeast. The demand for poles, wire and pole-line hardware, especially in Florida, continues good. In Alabama and Georgia the volume of line construction work is creating a satisfactory demand for construction materials, and a number of other long-distance transmission lines are projected for the near future. The outlook in this line for the remainder of the year is fine. Purchases by contractors are somewhat spotty, with the demand in Florida continuing and Birmingham and New Orleans very active in all lines of wiring materials and devices, but the movement in North Georgia is slow. The purchases seem to be equally divided between the larger and smaller contractors. One Atlanta jobber reports considerable interest and prospective activity in additional radio broadcasting stations, all of which are coming from Florida, as well as public address systems.

Orders from dealers for fall stocks of hollow ware, socket appliances and

heating devices are spotty, there being in some sections a disinclination to place these orders at this time, but orders from Mississippi and Louisiana are very satisfactory. Orders for current requirements in these lines show improvement over the past several weeks. Commercial, residential and industrial lighting fixtures are all in excellent demand with the residential type leading as regards volume of sales. Special campaigns set for September by jobbers to interest dealers in placing orders for fall stocks are expected to bring in good orders during the earlier part of the month. Jobbers are also making preparations for a record-breaking radio season this fall. There is no indication of a break in the long drought, and Southeastern hydro-electric power companies are either operating on curtailed schedules or have shifted industrial loads to night service when steam power is available. Collections are reported fair to good throughout the section. Credits are easy, though there is beginning to be a tightening up in credit extension in Florida, due to the fact that so many unseasoned contracting firms are entering the electrical construction field in this state.

Outlook Improving in Middle West—Buying in Good Volume

CONTINUED good business, with evidence of a better outlook, is reported from all parts of the Middle Western territory. Various common carriers serving the Middle West show gratifying increases in shipments of all commodities. Central-station companies are buying more liberally, as the feeling of cautiousness noticeable some months ago has abated somewhat. Among the interesting orders placed this week were one valued at over $125,000 for accessories for 600,000-circ.mil, 132-kv. cable, one for 100,000 lb. of weatherproof cable and one for several carloads of western red-cedar poles. Another order for 150,000 lb. of copper for the completion of a transmission line is reported from Ohio. There has been a good demand for pole-line hardware, high-tension fuses and switching equipment. A manufacturer of electric mine locomotives reports the first activity for some time. A good business is expected by all interests to accrue from a proposed lighting campaign that will be waged this fall. Electric truck sales have increased materially during the past few months for use in utility and commercial delivery service. Electrification of several Ohio River dredges and barges has called for considerable electric equipment and several oil engines.

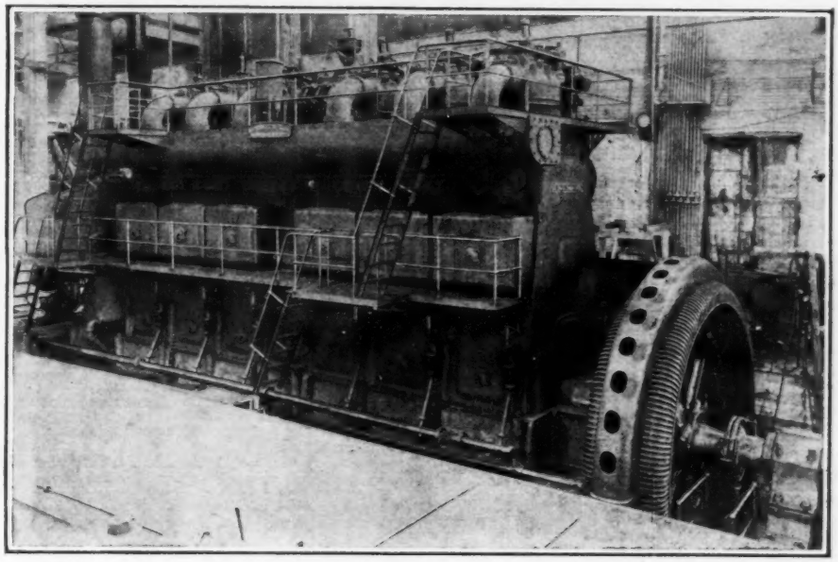
Jobbers' sales have accelerated somewhat this week. Appliances have been in good demand, particularly vacuum cleaners, one jobber placing an order recently for 1,000 machines. Radio sales are beginning to improve and there is an excellent volume of business in view. Prices remain firm generally. There were a few slight changes in pole-line hardware prices and a reduction in the price of locust pins and pin-type insulators announced this week. A 14 per cent reduction in the price of fiber was announced.

Activities of the Trade

Large Diesel Engine Generating Unit for Panama Canal

The first of the three 4,000-hp. Diesel engines which will be used to form a unit to generate most of the electrical energy used at the Panama Canal by the United States government has been completed by the Nordberg Manufacturing Company, Milwaukee. Fully eight months was required to build this unit. Work on the other two engines will start immediately.

This engine, which is considered the largest of its kind ever built in America, is 23½ ft. high, 25 ft. wide and 62 ft. long and weighs more than 1,000,000 lb. A specially constructed railroad car will transport it to New York for shipment to Panama by water. Before shipment from Milwaukee the engine will undergo a stringent acceptance test which requires a twenty-hour non-stop run, ending with five hours at full load and one hour with 10 per cent overload, all tests to be under the supervision of government and factory engineers.



ONE OF THREE 4,000-HP. DIESEL ENGINE GENERATING UNITS FOR USE AT THE PANAMA CANAL

Pittsburgh Transformer Opens Plant with Housewarming

The Pittsburgh Transformer Company will open its new Manchester plant on August 29 with a rather unusual reception and housewarming. For many years this company has tried to make its factory a neighborhood institution and to build up a personal contact between its officials and employees and the people living in the section round about. At the same time, the civic responsibility of the plant has been developed through a relationship between the factory and the city officials.

The opening of the new plant has therefore been made the occasion for a local celebration. The entire building has been decorated with flags and bunting, and a dancing floor of 12,000 square feet has been prepared for continuous dancing throughout the evening to music by two orchestras. Motion pictures and cards have also been provided and refreshments will be served from 9 o'clock to midnight. There will be a meeting that will be addressed by a former mayor and the present county commissioner, and the Mayor and City Council of Pittsburgh and other officials have been invited. Such friendly contact between the plant and its neighbors has had a very direct practical value in a sympathetic interest that has stopped all window breaking, pilfering and the other costly results of poor "public relations" that are too common.

Westinghouse Company Receives Large Equipment Contracts

A contract for equipment in excess of $250,000, necessary for the electrification of a 36-in. bloomer mill, has been awarded to the Westinghouse Electric & Manufacturing Company by the Phoenix Iron Company, Phoenixville, Pa. The new apparatus will change the mill entirely to electrical operation and will increase the electrical equipment of the plant by 4,350 hp. It is an addition to the Westinghouse drives for the 22-in. and 24-in. structure mills installed last year .

The main mill motor will consist of a 3,500-hp. reversing-mill motor with a range of 1 r.p.m. to 1.20 r.p.m. Electric current for the operation of this motor will be produced by a 3,000-kw. generator driven by a 2,500-hp. motor coupled with a 60,000-lb. flywheel. Auxiliaries include eight motors and two blowers. The contract also calls for three extra motors with a total capac-

ity of 850 hp. for the operation of water pumps.

The Westinghouse company has also received contracts for the electric generating plant of the United Electric Light Company, supplying current in the Westinghouse valley.

William Cramp & Sons Report Active Hydraulic Business

The hydraulic business of the William Cramp & Sons Ship & Engine Building Company, its subsidiaries and licensees has been very active during recent months. The company announces that contracts have been booked for machinery to be installed not only in the United States and Canada but also in Brazil. Some of these units are said to be the largest of their kind.

Among the important contracts lately secured by the Cramp company for installations in this country are the following: Four units for the Great Northern Paper Company for the Dolby Mills, Maine, aggregate capacity 7,800-hp.; one 10,000-hp. turbine for the Rumford Falls Power Company, Rumford, Me.; four 18,000-hp. units for the West Virginia Power & Transmission Company, Cheat Haven, Pa., and one 45,000-hp turbine for the Cherokee Bluffs plant of the Alabama Power Company. The last-named unit will be the highest powered turbine in the Southern States. The Pelton Water Wheel Company, San Francisco, which is owned by the Cramp company, has been awarded a contract for two 40,000-hp. impulse turbines for installation in Brazil. It is said that these units will be the highest-powered impulse turbines in the world.

The Dominion Engineering Works, Ltd., Montreal, Canadian licensees of the Cramp company, have secured contracts as follows: Three units for the Powell River development, British Columbia, aggregating 25,800 hp.; one 5,000-hp. unit for the Maine & New Brunswick Power Company, one 1,550-hp. unit for the Abitibi Pulp & Paper Company, and two 10,000-hp. units for the Shawinigan Engineering Company.

Servel Plans Large Merger and Makes New Stock Offering

To provide additional working capital the Servel Corporation made a new public offering this week of 125,000 shares of class A stock at $30 per share through Watson & White, members of the New York Stock Exchange. A special meeting of the stockholders of the corporation has been called for September 11 at Richmond, Va., to approve an increase in the authorized class A stock from 115,000 shares to 500,000 shares and in the class B stock from 115,000 shares to 500,000 shares, to enable it to acquire the Hercules Corporation and the Wheeler Condenser & Engineering Company.

Plans for a merger of the Hercules Corporation and the Wheeler Condenser & Engineering Company with the Servel Corporation have been announced.

The Servel Corporation in a letter to its stockholders states that the Hercules plant at Evansville, Ind., and the Wheeler plants at Carteret, N. J., and Newburgh, N. Y., will, with additional machinery and equipment now being installed, have facilities for turning out 100,000 refrigerating units annually, as well as a large number of commercial machines and other products. The management of the company will continue in the hands of the men who have been responsible for its success and development, supplemented by a number of leading public utility executives who have recently acquired a substantial interest in the Servel Corporation, as related in the August 15 issue of the ELECTRICAL WORLD.

Sales Conferences at Edison Lighting Institute Well Attended

The junior sales conference held at the Edison Lighting Institute, Harrison, N. J., July 20-25, was attended by representatives from about thirty wholesale and central-station companies and twenty representatives from various divisions of the General Electric Company. The women's conference, held July 27-31, was attended by thirty representatives from various central-station companies. Lectures were given by lighting engineers and merchandising specialists of the Edison Lamp Works on the fundamentals of illumination, store and window lighting, the sales value of light, industrial lighting, street lighting, home lighting and the development of the tungsten lamp. The lectures were accompanied by demonstrations of correct lighting given in the various demonstration rooms.

The women's conference was devoted almost exclusively to the study of home lighting. House wiring, the designing of home lighting, inspection of homes under process of construction and the study of special home-lighting problems were given particular attention.

The Chicago Fuse Manufacturing Company, Laflin and Fifteenth Streets, Chicago, announces a new design of its "Union" renewable knife-blade fuse, which it has recently developed and placed on the market.

The General Electric Company, Los Angeles, has completed plans for a three-story equipment storage and distributing plant at Fifty-second Street and Santa Fe Avenue, to be 80 ft. x 240 ft., with two-story L-shaped building adjoining to be used for office and other operating service. The Austin Company, 777 East Washington Street, Los Angeles, is architect and engineer.

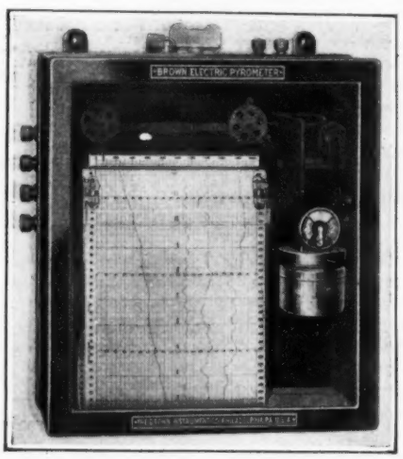
The Hart Manufacturing Company, Hamilton Street, Hartford, Conn., manufacturer of electrical supplies, has awarded a general contract for a new one-story addition, 50 ft. x 82 ft., to be equipped primarily as a plating works.

The Westinghouse Electric & Manufacturing Company has received a contract for equipment for two substations of the Staten Island Rapid Transit Railway Company. This apparatus includes rotary converters, transfomers, automatic switching equipment and supervisory control and will take care of the increased load for the North Shore and the Perth Amboy divisions.

New Equipment Available

Recording Pyrometer

A recording pyrometer built to make a single record, a duplex record with two records side by side, or in multiple form as many as twelve records on one chart, has been developed by the Brown Instrument Company, Philadelphia. The instrument operates on the frictionless principle in which a pointer swings freely and at intervals of every thirty seconds is depressed on a carbon or inked ribbon, producing a mark on the chart which has rectangular co-ordinates. These marks are close together and form a continuous line. The marking ribbon and chart last two months before renewal is required, and no inking is necessary. A platen is supplied with the instrument, by means of which notes can be recorded on the chart.



BROWN RECORDING PYROMETER WITH FOUR RECORDS ON ONE CHART

The galvanometer and the recording chart mechanism is carried on a hinged frame, which when swung aside makes the galvanometer readily accessible, and when closed a housing projects the galvanometer. The recorder is driven by an electric clock if alternating current is available. The chart speed can readily be changed and is supplied for a number of combinations.

Disconnecting Switch

A new 120-kv., 600-amp. single-pole disconnecting switch, hook-stick-operated, has been developed by the Delta-Star Electric Company, 2433 Fulton Street, Chicago. The insulators used on this switch are of the interchangeable unit type mounted on a steel channel base. The terminals are equipped with strain clamps to prevent any conductor pull on the current-carrying lugs, and all steel and iron parts are hot-galvanized.

New Trade Literature

LIGHTNING ARRESTERS — Circular 1,737, entitled "Adequate Lightning Protection," issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes its new "Autovalve" lightning arresters. It contains a short sketch of the general principle of lightning arresters, characteristics of surges, danger of high voltages and steep wave fronts, etc. A description of various types of the "Autovalve" arresters is given, which includes the LV and SV station types, LV distribution type and LV arresters for secondary circuits. Illustrations are given showing various installations, and in addition to several curves and sketches a map prepared by the United States Weather Bureau, showing the average number of thunderstorms per season is included.

MOTOR BEARINGS. — "The Care of Railway Motor Bearings" is the title of publication GEA-60, issued by the General Electric Company, Schenectady, N. Y., which gives directions for the correct lubrication of sleeve-type bearings, considering both armature and axle linings. Instructions are also given for rebabbitting bearings. Photographs showing methods of lubrication and a table showing proper oil levels are included.

SINGLE-PHASE MOTORS.—"They Keep a-Runnin' Quietly" is the title of a bulletin issued by the Century Electric Company, St. Louis, in which it calls attention to the quiet characteristics of the Century type RS repulsion-start induction single-phase motors.

AUTOMATIC PERCOLATORS.—Through its merchandising department at Mansfield, Ohio, the Westinghouse Electric & Manufacturing Company has issued a bulletin covering a new line of automatic percolators. This publication describes the application of the disk type thermostat to percolators and also includes a description of some of the fuse-type percolators.

ELECTRICAL WIRING DEVICES. — Harvey Hubbell, Inc., Bridgeport, Conn., has issued Catalog No. 18, containing 104 pages, in which are listed the Hubbell wiring devices, together with illustrations, dimensions, etc.

DISTRIBUTION TRANSFORMERS. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing leaflet L-20, 138-A, describing its new type SC steel-clad distribution transformers for single-phase service on small isolated outside substations feeding from high-tension lines.

ARC WELDER.—"Lincoln 'Stable-Arc' Welder" is the title of a bulletin issued by the Lincoln Electric Company, Cleveland, in which it describes the Lincoln method of arc welding and gives the advantages of the "Stable-Arc" welding over other devices for welding. It contains illustrations showing the various types of Lincoln welders, including the portable-truck type, gasoline-engine-driven, special railroad types, etc. A list of some of the firms using the "Stable-Arc" welders is included.

OIL CIRCUIT BREAKERS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing leaflet L 20,253 covering its types D, F-1, F-2 and F-3 oil circuit breakers, manually and electrically operated, non-automatic and automatic, for outdoor and subway service, single-throw and double-throw. A description of the construction of the tanks, tank linings, mechanism and contacts is included.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Kobe, Japan (No. 16,529), of ebonite sheets for radio apparatus.

Purchase is desired in Caracas, Venezuela (No. 14,462), of electrical apparatus for current of 220 volts, three-phase, 50 cycles, and electric soldering apparatus.

An agency is desired in Berlin, Germany (No. 16,486), for electrical equipment of all kinds, patented articles and novelties and radio sets and parts.

Purchase is desired in Chihuahua, Mexico (No. 16,518), of electric generator of 100 hp., wire and insulators and 30-hp. and 40-hp. motors and one transformer, and gas-producer engine, with producer, cooler and other equipment.

An agency is desired in Liverpool, England (No. 16,533), for electrical household devices.

Purchase is desired in Olincourt, France (No. 16,513), of small electric motors.

Purchase or agency is desired in The Hague, Netherlands (No. 16,485), for Single-phase motors for sewing machines.

An agency is desired in Montevideo, Uruguay (No. 16,487), for radio sets and parts.

An agency is desired in Vancouver, Canada (No. 16,488), for radio sets and parts.

Purchase and agency is desired in Stuttgart, Germany (No. 16,484), for magnet wires, wound with silk and cotton.

An agency is desired in Melbourne, Australia (No. 16,370), for radio sets and parts.

An agency is desired in Buenos Aires, Argentina (No. 16,371), for radio sets and parts.

An agency is desired in Tangier, Morocco (No. 16,372), for radio sets and parts.

An agency is desired in Copenhagen, Denmark (No. 16,373), for radio sets and parts.

Purchase is desired in Naples, Italy (No. 16,458), of telephone apparatus.

An agency is desired in Dresden, Germany (No. 16,441), for electric window display signs.

An agency is desired in Newcastle, England (No. 16,424), for electric drilling machines and electric locomotives for mines.

An agency is desired in Bombay, India (No. 16,379), for copper and yellow metal sheets.

An agency is desired in Amsterdam, Netherlands, for copper wire and electrolytic copper wire.

Construction News

Projects, Plans, Bids and Contracts,
Contemplated or Under Way

New England States

GORHAM, ME.—Plans are being considered by the Cumberland County Light & Power Company, Portland, to extend its lines to West Gorham.

MASCOMA, N. H.—The New England Company, Worcester, Mass., which is negotiating for the purchase of the property of the Mascoma Light & Power Company, contemplates extensions in transmission lines.

PORTSMOUTH, N. H.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until September 8, for switchboards, bushings, etc., for the local navy yard (Schedule 4291).

CAMBRIDGE, MASS.—The Cambridge Electric Light Company is planning to construct a substation.

HOLYOKE, MASS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 24 for the installation of one full-magnet electric freight elevator in the United States post office at Holyoke. For details see Searchlight Section.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 8 for furnishing electric wire and cable, steel-wire rope, electric strand, etc., to the Navy Yard, Brooklyn, and for furnishing steel and phosphor bronze-wire rope, brass, copper, iron, steel, lead, phosphor-bronze and resistance wire, tachometers, etc., at the Navy Supply Depot, Brooklyn.

BUFFALO, N. Y.—Bids will be received by the Commissioner of Public Works, Municipal Building, until Sept. 17 for electric wiring and apparatus for the filter plant. The work will include all wiring for light and power, electric light fixtures, cabinets, switchboards, remote control, automatic control and transformers, with necessary wire, ducts, conduits and apparatus to complete the installation in the head house, filter building and the low-lift pumping station. George C. Andrews is engineer of filtration building.

ENDICOTT, N. Y.—Plans for the proposed new building at the Endicott Hospital, to cost about $250,000, include a power plant. Walter Whitlock, Security Mutual Building, Binghamton, is architect.

JAMESTOWN, N. Y.—The installation of an electrically operated traffic control system is under consideration by the Department of Public Safety.

PAWLING, N. Y.—The Harlem Valley Electric Corporation has applied for permission to extend its lines to Lewisboro to furnish electric service there.

ROCHESTER, N. Y.—Plans for the proposed new factory of the Crescent Children's Shoe Manufacturing Company, 77 Mount Hope Avenue, to cost about $150,000, include a power plant.

ROCHESTER, N. Y.—The Rochester Gas & Electric Corporation has applied to the Public Service Commission for permission to extend its lines to the town of Victor and to supply electric service under a franchise granted by the Town Board.

SYRACUSE, N. Y.—Plans are under way to extend the ornamental lighting system through the main streets of the city to the city limits.

GREENSBURG, PA.—Plans are under way by the West Penn Power Company, Pittsburgh, for the installation of a new ornamental lighting system.

HANOVER, PA.—The Chamber of Commerce has recommended the installation of an ornamental lighting system in the business district, to cost about $9,000. Of this amount the organization offers to pay $6,000.

LEBANON, PA.—The installation of a fire-alarm system throughout the city is under consideration by the City Council.

PHILADELPHIA, PA.—Plans have been filed by John Zimmerman & Sons, Torresdale Avenue and N. Street, for a power house, to cost about $25,000.

SHARON, PA.—The City Council is considering extending the ornamental lighting system on Porter Way Avenue.

CINNAMINSON, N. J.—Bids will be received by George C. Frank, Township Clerk, Cinnaminson (Riverton P. O.), until Oct. 1 for lighting the roads and streets of Cinnaminson Township with incandescent lamps for a period of five years.

COLLEGE PARK, MD.—Plans are being prepared by Smith & May, Calvert Building, Baltimore, for an administration building, dining room and power plant for the University of Maryland, to cost about $225,000.

WASHINGTON, D. C.—Bids will be received by the Chief of Air Service until September 15 for 435 aircraft storage batteries (Proposal 15.)

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until September 15 for 20,975 dry batteries.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until September 21, for 5,000 ft. power cable, rubber-insulated; rubber-insulated copper wire, bell-ringing transformers, etc. (Panama Circular 1693.)

North Central States

AKRON, OHIO. — The Northern Ohio Traction & Light Company contemplates extending its power system to serve the towns of Copley, Richfield, Aurora and Highland Springs. The cost is estimated at about $100,000.

AVON, OHIO.—The local power plant of the Lake Shore Electric Railway Company, Cleveland, was recently destroyed by fire, causing a loss of about $250,000.

DEFIANCE, OHIO.—At the election to be held in November the proposal to construct a municipal electric plant and distributing system, to cost about $425,000, will be submitted to the voters.

SPRINGFIELD, OHIO.—Plans are under way by the Ohio Edison Company for the construction of a large power plant at the confluence of Buck Creek and Mad River, near Springfield. The plant will consist of boiler section, turbo-generator section and condensing section and will develop more than 135,000 hp. The cost is estimated at $1,800,000. Schilling & Eastman, Springfield, are architects.

CARROLLTON, KY. — The Kentucky Power Company, Augusta, plans to build an addition to its local power plant, to cost about $75,000.

COVINGTON, KY.—A resolution providing for the installation of ornamental

lamps on Scott Boulevard from the Suspension Bridge to Sterritt Avenue has been submitted to the City Commissioners.

CHAMPAIGN, ILL.—The Illinois Power & Light Corporation plans to build a storage and distributing plant, to cost about $130,000. Royer, Danely & Smith, Flatiron Building, Urbana, are architects.

CHICAGO, ILL.—Tentative plans have been prepared for extensions and improvements to the Indiana Harbor plant of the Inland Steel Company involving an expenditure of about $2,000,000. The plans provide for the electrification of the entire "No. 1 side" of the plant and the addition of seventy-seven coke ovens.

GREAT LAKES, ILL.—Bids will be received by the Construction Division, United States Veterans' Bureau, Washington, D. C., until September 15, for furnishing and installing cables and wiring for an automatic telephone system at the local Veterans' Hospital No. 105.

MATHERVILLE, ILL. — Arrangements have been made by the Village Board with the Sherrard Power Company, Orion, for installing street lamps throughout the residential district. Improvements will also be made to the system on Main Street.

COLOMA, WIS.—The Village Council has granted the Wisconsin Power & Light Company to furnish electric service here. The company will extend its high-tension line to Coloma and take over the present system.

HUSTISFORD, WIS.—A new wooden dam will be built by the Hustisford Light & Manufacturing Company across the Rock River at Hustisford, to replace the old dam. Provision will be made to replace it later with a concrete structure.

KAUKAUNA, WIS.—The War Department has granted the Green Bay & Mississippi River Canal Company permission to build a hydro-electric plant at Rapid Crouche dam, located about 4 miles below Kaukauna, on the Fox River. The plans call for a development of about 3,000 hp., to cost about $500,000. A transmission line will be erected from the plant to Kaukauna. When completed the plant will be leased to the city of Kaukauna.

SUPERIOR, WIS. — Improvements are contemplated by the Superior Shipbuilding Company, to cost about $50,000, which will include dismantling the present power plant and building a new power station.

WITTENBERG, WIS. — Arrangements have been made by the Middle West Utilities Company, Chicago, to connect the systems of the Wittenberg Light & Power Company and the Central Wisconsin Power Company, Oshkosh, recently acquired, with a 33,000-volt transmission line 20 miles long.

DULUTH, MINN. — Steps have been taken by the City Commission to extend the ornamental lighting system to the business section of the East.

LITTLE FALLS, MINN. — The City Council has contracted with the Minnesota Power & Light Company, Duluth, for the installation of an ornamental lamp on a portion of First Street, S.E.

PLUMMER, MINN.—Plans are being prepared by the Minnesota Electric Distributing Company, Minneapolis, to erect a transmission line from Holt to Plummer, to be tied in with the Crookston Division system.

RED WING, MINN.—The City Council is negotiating with Northern States Power Company, Minneapolis, for the installation of a new lighting system in the business district, to replace present arc lamps.

ST. PAUL, MINN.—The City Council has passed an ordinance providing for the installation of an improved street-lighting system on about 50 miles of city streets, to cost about $360,000. G. M. Shepard is city engineer.

ST. PAUL, MINN.—An order providing for the installation of ornamental electric lamps under the St. Anthony Park plan, at a cost of about $56,000, to replace 1,750 gas lamps, for the Hill, Merriam Park, Macalester Park and St. Anthony Park. Manvel and Pearl Streets and Bayless and Cromwell Avenues in South Anthony Park were eliminated from the order, which will be served with electric lamps on poles at the street intersections.

ANKENY, IOWA.—The Fort Dodge, Des Moines & Southern Railroad Company, Fort Dodge, is planning to rebuild its transformer station, recently destroyed by fire.

PROMISE CITY, IOWA. — Plans are being prepared for a municipal electric lighting system, for which bonds have been issued.

WATERLOO, IOWA.—Work will soon begin by the Central Iowa Power & Light Company on the erection of a high-tension transmission line to supply electricity to the east factory district. This line will cost about $40,000 and will form a portion of the loop connecting the entire factory district.

KANSAS CITY, MO.—The Washburn-Crosby Company, Minneapolis, plans to install electric power equipment in its proposed local flour mill, to cost about $200,000.

FARGO, N. D.—The City Council is considering the installation of ornamental lamps on Third, Fourth and Fifth Streets and First Avenue.

HEBRON, N. D.—The Hughes & Deiters Company, Dickinson, has secured a right-of-way for the erection of a transmission line from Dickinson to Hebron.

LANDA, N. D.—George Baska and associates, connected with the Mohall (N. D.) electric light plant, are considering the construction of a local power plant.

McCLUSKY, N. D.—The Central Light & Power Company, Garrison, plans to reconstruct its transmission line between Turtle Lake and McClusky for higher-voltage service.

BLOOMFIELD, NEB.—Bids, it is understood, will soon be asked for the construction of a municipal electric system. H. L. Cory & Company, Aberdeen, S. D., are consulting engineers.

LINCOLN, NEB.—Plans are being prepared for the construction of a power plant at the Methodist Hospital, at Forty-eighth Street and Sumner Avenue. Fiske, Meginnis & Schaumberg, Bankers' Life Building, are architects.

WAHOO, NEB.—Plans have been prepared for an addition to the municipal electric plant.

ARKANSAS CITY, KAN. — Plans are being prepared by the Kansas Gas & Electric Company, Wichita, for the construction of a local substation, to cost about $85,000.

CONCORDIA, KAN.—The Kansas Power Company, which is erecting a transmission line between Jamestown and Mankato, will soon begin work on construction of the Jamestown-Concordia line, which will eventually be extended to Phillipsburg. The new line will carry 33,000 volts instead of 13,000 volts, now carried by the present line. The company plans to rebuild the line between Jamestown and Glasco next year.

Southern States

DURHAM, N. C.—The City Council has requested the Durham Public Service Company to submit estimates of cost for extending the electric lighting service in the new extension territory.

GREENSBORO, N. C.—The North Carolina Public Service Company plans to erect a transmission line from Durham to Efland and to build a local substation.

RALEIGH, N. C.—The Carolina Power & Light Company plans to build an electric car barn, shop and garage, to cost about $86,000.

THOMASVILLE, N. C.—The Southern Public Utilities Company, Charlotte, plans extensions in its transmission lines in this section.

ALBANY, GA.—The Columbus (Ga.) Electric & Power Company, which recently acquired the property of the Georgia-Alabama Power Company and the South Georgia Public Service Company, contemplates extensions to its transmission lines in this section.

BROOKSVILLE, FLA.—The installation of an ornamental lighting system in the business district, to cost about $15,000, is under consideration by the City Council.

HAINES CITY, FLA.—The City Commissioners are considering the installation of an ornamental lighting system to cost about $20,000.

LAKE CITY, FLA.—Bids will be received by the Construction Division, United States Veterans' Bureau, Washington, D. C., until Sept. 15, for furnishing and installing cables and wiring for an automatic telephone system at the local Veterans' Hospital No. 63; also, at the same time, for a similar system in Veterans' Hospital No. 104, San Fernando, Fla.

MANATEE, FLA.—The City Council is considering the installation of an ornamental lighting system on a number of streets, including Manatee Avenue.

ORLANDO, FLA.—The City Council has approved the plans submitted by the Orlando Utilities Commission for extending the ornamental lighting system (consisting of about 600 lamps) from the northern limits to the southern limits of the city and has authorized the Utilities Commission to install the system. Ornamental lamps will also be installed on Church and Central Avenues. The cost of the work is estimated at about $60,000. The cost of the lamps and standards will be assumed by the commission, while the city will pay for energy consumed.

PUNTA GORDA, FLA.—The City Council is considering extensions to the municipal electric system, to cost about $40,000.

CHAPEL HILL, TENN.—The Southern Cities Power Company, Chattanooga, plans to erect a transmission line to this district for commercial light and power service.

CHATTANOOGA, TENN.—Plans for the proposed local car and locomotive repair shops to be erected by the Southern Railway Company, Washington, D. C., at a cost of about $750,000, include a power plant. The company also plans to install electric power equipment in connection with the proposed rebuilding of its shops at Knoxville, recently damaged by fire with loss of about $225,000.

HUMBOLDT, TENN.—Steps have been taken by the Chamber of Commerce for the installation of ornamental lamps on Twelfth Avenue from the Union Station to Main Street.

KNOXVILLE, TENN. — The Knoxville Power & Light Company plans to install an underground conduit system in a number of streets in the business district.

LENOIR CITY, TENN.—The Tennessee Electric Power Company, Chattanooga, plans to erect a transmission line on the Kingston Pike to the Ten Mile Creek district for light and power service.

Pacific and Mountain States

ELLENBURG, WASH.—The City Council has engaged Bear & Cunningham, engineers, Portland, Ore., to prepare a report for extensions and improvements to the municipal hydro-electric plant. An offer made to purchase the plant has led the Council to authorize the survey and report to determine whether it is advisable to sell or to enlarge the plant. The present capacity of the plant is 1,500 kw.

PORT LUDLOW, WASH.—Plans for the proposed lumber mill of the McCormick Lumber Company, San Francisco, Cal., to cost about $500,000, include a power house.

RAYMOND, WASH.—Work has begun on the erection of an electric transmission line by the Willapa Electric Company from Raymond to East Raymond and Willapa, which at present are without electric service. The cost is estimated at $15,000.

SEATTLE, WASH.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until September 8 for 166 electric switches for the Puget Sound Navy Yard (Schedule 4292).

SEATTLE, WASH.—The Puget Sound Power & Light Company has applied to the Commissioners of Kitsap County for permission to extend its lines into Kitsap County. It is proposed to extend its lines from the Baker River power plant through the county to furnish power in Bremerton and the Puget Sound navy yard.

TACOMA, WASH.—Application has been filed by the Siegmund Gold Mining Company, Post Office Box 275, Tacoma, for permission to use water from Little Ohop Creek for a hydro-electric development to supply power for its mines.

KLAMATH FALLS, ORE. — Plans for the proposed local car and locomotive shops of the Southern Pacific Company, San Francisco, to cost about $350,000, include a power house.

BAKERSFIELD, CAL.—The City Council has completed plans for the installation of ornamental lamps on about forty city blocks. Bids recently asked for a portion of the improvement have been rejected.

MAGALIA, CAL.—The Pacific Gas & Electric Company, San Francisco, plans to extend its system on Magalia to furnish electric service here.

TURLOCK, CAL.—Plans are under way for the installation of ornamental lamps on Crane Avenue between South Center and Minaret Streets. Horace A. Hall is city engineer.

VENICE, CAL.—The City Council is considering the installation of a fire-alarm system, to cost about $75,000, and a police signal system, to cost about $50,000.

KELLOGG, IDAHO.—The Washington Water Power Company, Spokane, plans to rebuild its transmission line from Coeur d'Alene to Kellogg for higher-voltage service.

Electrical Patents

Announced by U. S. Patent Office

(Issued August 4, 1925)

1,548,020. REVERSING MEANS FOR ELECTRIC TOOLS; S. D. Black and A. G. Decker, Baltimore County, Md. App. filed March 14, 1924.

1,548,022. INDUCTANCE DEVICE; W. L. Casper, Brooklyn, N. Y. App. filed April 23, 1923. Transformer.

1,548,024. MEANS FOR DETECTING SUBMARINES AND OTHER INVISIBLE OBJECTS; J. H. Gunts, Hoboken, N. J. App. filed July 17, 1917.

1,548,028. TRANSMISSION SYSTEM; H. C. Egerton, Ridgewood, N. J. App. filed Oct. 7, 1918. For the transmission of speech.

1,548,039. TWO-RAY REPEATER; J. S. Jammer, New York, N. Y. App. filed June 29, 1923. Amplifying repeater as employed in multiplex carrier-current telephone and telegraph systems.

1,548,059. ELECTRICAL TESTING SYSTEM; H. Nyquist, Elmhurst, N. Y. App. filed July 16, 1921. For determining degree of unbalance between two networks, as a signaling circuit and the network to balance that circuit.

1,548,060. PRINTING TELEGRAPH SYSTEM; H. Pfannenstiehl, Maplewood, N. J. App. filed July 29, 1922.

1,548,062. COUPLING ARRANGEMENT FOR MULTIPLEX TRANSMISSION; P. H. Pierce, New York, N. Y. App. filed Sept. 4, 1919. For signaling circuits.

1,548,074. HIGH-POTENTIAL VOLTMETER; H. F. Waite, New York, N. Y. App. filed Oct. 26, 1921.

1,548,088. TELEGRAPH CIRCUITS; J. Herman, New York, N. Y. App. filed April 5, 1922.

1,548,090. ELECTRIC SIGNALING DEVICE; A. Lindsten, White Bear Lake, Minn. App. filed March 22, 1923.

1,548,095. VACUUM-TUBE TRANSLATING DEVICE; H. S. Osborne, Montclair, N. J. App. filed March 3, 1921.

1,548,110. TELEPHONE-TOLL CIRCUITS; J. G. Toomey, New York, N. Y. App. filed June 9, 1923.

1,548,111. MULTIPLE SAFETY FUSE; E. Antinoro, Rome, Italy. App. filed June 15, 1921.

1,548,119. BUSY-TEST CIRCUIT FOR TELEPHONE CORD CIRCUITS; E. Dietze, Brooklyn, N. Y. App. filed Aug. 15, 1923.

1,548,129. LAMP-SOCKET INCLOSURE; H. A. Framburg, Berwyn, Ill. App. filed April 30, 1921.

1,548,168. PRINTING TELEGRAPHY; H. Pfannenstiehl, Maplewood, N. J. App. filed Dec. 24, 1920.

1,548,204. WATER-COOLED PORTABLE ELECTRIC WELDING MACHINE; M. W. Moesta, Detroit, Mich. App. filed March 24, 1924.

1,548,225. FLASHLIGHT; L. M. Topoosian, Springfield, Mass. App. filed Sept. 17, 1923.

1,548,226. MAGNETO; E. Irbain and C. Scal, Paris, France. App. filed July 25, 1921.

1,548,238. SUPPORT FOR ELECTRIC LAMPS; W. A. Adams, Rochester, N. Y. App. filed March 7, 1922.

1,548,260. MULTIPLEX SYSTEM; L. Espenschied, Hollis, N. Y. App. filed Sept. 19, 1919. Radio and wire transmission systems.

1,548,267. HIGH-FREQUENCY CARRIER SIGNALING; R. A. Heising, East Orange, N. J. App. filed March 26, 1920.

1,548,300. TESTING DEVICE; W. J. Anglemyer, Evanston, Ill. App. filed Dec. 24, 1921. For automatic telephone system.

1,548,303. ELECTRIC FUSE; H. T. Bussmann, St. Louis, Mo. App. filed May 7, 1919. Refillable cartridge type.

1,548,305. ELECTRICAL HEATER AND HEATING UNIT THEREFOR; W. H. Dalton, Salem, Mass. App. filed March 24, 1923.

1,548,347. CLIP FOR SWITCHES AND SIMILAR DEVICES; W. A. Braden, Cleveland, Ohio. App. filed June 7, 1924.

1,548,362. ELECTROLYTIC APPARATUS; C. F. Holmboe, Ris, near Christiania, Norway. App. filed Sept. 4, 1924. Of very large dimensions.

1,548,388. TRANSFORMER; W. J. Shackelton, Scotch Plains, N. J. App. filed April 26, 1923. Power transformer for use in high-frequency circuits.

1,548,397. ELECTRIC WELDING MACHINE; A. C. Taylor, Warren, Ohio. App. filed Jan. 16, 1925.

1,548,406. SMOKER'S EQUIPMENT FOR VEHICLES; H. F. Boes, Philadelphia, Pa. App. filed Feb. 10, 1925.

1,548,422. TROLLEY WHEEL; G. S. Moore, Indianapolis, Ind. App. filed May 31, 1923.

1,548,466. BRUSH FOR ELECTRICAL MACHINES; F. Hettinger, Rutherford, N. J. App. filed June 22, 1921.

1,548,479. GOVERNOR; J. A. Obermaier, Chicago, Ill. App. filed Aug. 7, 1922. For maintaining constant the speed of an electric motor.

1,548,503. LIGHT CONNECTION TERMINAL; La Verne H. Beam, Kalamazoo, Mich. App. filed Oct. 14, 1921.

1,548,552. BATTERY CONNECTION; J. F. Prax, Rochester, N. Y. App. filed June 16, 1920.

1,548,577. ELECTRICAL RECEPTACLE; R. B. Benjamin, Chicago, Ill. App. filed March 10, 1920. Comprising removably connected base and casing parts.

1,548,592. TESTING CIRCUITS; H. Fletcher, New York, N. Y. App. filed Nov. 16, 1921. Method of measuring the efficiency of electrical speech transmission instruments.

1,548,596. ADJUSTABLE MAGNETIC YOKE; J. J. Ghegan, East Orange, N. J. App. filed June 11, 1921. For use with electromagnets and electrical instruments.

1,548,597. SIGNALING SYSTEM; J. J. Gilbert, Port Washington, N. Y. App. filed Nov. 14, 1921. Submarine cable-telegraph systems.

1,548,604. TERMINAL CONNECTOR; W. J. Hunter, New York, N. Y. App. filed Jan. 19, 1923.

1,548,606. ELECTROMECHANICAL MOVEMENT; C. F. Hutchinson, Waterville, Me. App. filed Nov. 17, 1923. Wherein increments of movements of one member are imparted to another member at a distance therefrom in the same order or direction.

1,548,650. ELECTRIC SWITCH; C. E. Anderson, Stratford, Conn. App. filed July 15, 1924. Push-bar type.

1,548,651. LIGHT-PROJECTING APPARATUS; F. A. Benford, Schenectady, N. Y. App. filed June 29, 1922.

1,548,656. FILM CUT-OUT; H. E. Butler, Schenectady, N. Y. App. filed May 5, 1922. For series incandescent street lighting.

1,548,658. COMBINED TANK AND CORE FOR INDUCTION APPARATUS; F. J. Champlin, Pittsfield, Mass. App. filed Aug. 16, 1921. Adapted to contain a quantity of cooling liquid as oil.

1,548,660. ELECTRICAL INSTRUMENT; R. C. Clinker, Rugby, England. App. filed Jan. 29, 1921. For measuring electrical values as frequency, capacity or inductance.

1,548,666. GOVERNING MECHANISM; E. D. Dickinson, Schenectady, N. Y. App. filed Sept. 30, 1921. For prime movers.

1,548,678. PENDENT ELECTRIC FITTING; G. W. Goodridge, Fairfield, Conn. App. filed May 12, 1924. Combination attachment plug receptacle and switch for controlling a secondary circuit.

1,548,679. AUTOMATIC TELEPHONE SYSTEM; G. Grabe, Nikolassee, near Berlin, Germany. App. filed Dec. 18, 1922.

1,548,691. LINE WELDING; E. Thomson, Swampscott, Mass. App. filed Aug. 11, 1924.

1,548,715. ELECTRICAL INSULATOR BLOCK; R. A. Dennis, Ashtabula, Ohio. App. filed May 2, 1921. For use in wiring buildings.

1,548,741. ELECTRIC LIQUID HEATING SYSTEM; A. D. Pou, Buenos Aires, Argentina. App. filed Oct. 20, 1923.

1,548,742. APPARATUS FOR ELECTRICALLY HEATING LIQUIDS; A. D. Pou, Buenos Aires, Argentina. App. filed Oct. 20, 1923.

1,548,754. REGULATING SYSTEM FOR DYNAMO-ELECTRIC MACHINES; C. J. Sarjeant, Rugby, England. App. filed Nov. 28, 1923. For automatic substations.

1,548,757. ELECTRON-DISCHARGE DEVICE; J. Scott-Taggart, London, England. App. filed Nov. 30, 1920.

1,548,775. REGULATING SYSTEM; R. M. Carothers, Schenectady, N. Y. App. filed Aug. 18, 1924. For controlling a characteristic of the output of a generator.

1,548,779. PORTABLE HOT-WATER GENERATOR; W. Falkenberg, New York, N. Y. App. filed June 6, 1923.

1,548,793. MAGNETIC CHUCK; J. Bing, Eisenach, Germany. App. filed Aug. 6, 1923.

1,548,799, 1,548,800. ELECTRIC SWITCH; J. D. Hilliard, Schenectady, N. Y. App. filed Aug. 10, 1921, and April 27, 1923. Oil-break type.

1,548,811. SYSTEM OF CONTROL BY LIGHT WAVES; J. H. Hammond, Jr., Gloucester, Mass. App. filed Jan. 6, 1920.

1,548,812. HIGH-PRESSURE ARC; W. E. Story, Jr., Washington, D. C. App. filed July 5, 1922.

(Issued August 11, 1925)

1,548,826. HEAT COIL; H. D. Currier, Chicago, Ill. App. filed April 15, 1920. Thermal overload cut-out.

1,548,828. ELECTRIC HEATER; J. C. Donelan, Springfield, Ill. App. filed Nov. 11, 1924. Small heaters such as are used by dentists in laboratory work.

1,548,840. ELECTRODE FOR ELECTROLYTIC DECOMPOSITION APPARATUS; C. F. Homboe, Riis, near Christiania, Norway. App. filed July 23, 1924.

1,548,856. STRAIN INSULATOR; L. Steinberger, Brooklyn, N. Y. App. filed Sept. 23, 1921.

1,548,858. METHOD OF ELECTRICAL WELDING; A. C. Taylor, Warren, Ohio. App. filed Feb. 3, 1923. For spot-welding metal sheets or other parts.

1,548,862. INTERFERENCE-NEUTRALIZING ARRANGEMENT; O. B. Blackwell, Garden City, N. Y. App. filed Aug. 14, 1920. In a signaling system.

1,548,873. TELEGRAPH SIGNALING SYSTEM; J. M. Fell, Hackensack, N. J. App. filed March 15, 1920. Means for applying the duplex and half-duplex methods of operation to local loop circuits.

1,548,874. TELEGRAPH SIGNALING SYSTEM; J. M. Fell, Hackensack, N. J. App. filed March 15, 1920. For preventing the reaction between the polar relays of a duplex system.

1,548,878. ELECTRICAL SIGNALING SYSTEM; D. K. Gannett, Arverne, N. Y. App. filed April 19, 1920. To suppress effect upon receiving apparatus of very low-frequency disturbances that may be set up.

1,548,883. ELECTRIC SWITCH AND TEST DEVICE; B. D. Horton, Detroit, Mich. App. filed April 22, 1913. Service and meter-test device.

1,548,895. ELECTRICAL TRANSMISSION OF PICTURES; P. Mertz, Ithaca, N. Y. App. filed Jan. 26, 1923.

1,548,943. ELECTRICAL CIRCUITS FOR MOTION-PICTURE PROJECTORS; N. B. Green, Rochester, N. Y. App. filed Jan. 13, 1922.

1,548,947. TELEGRAPH SYSTEM; R. A. Heising, Millburn, N. J. App. filed May 29, 1922. Multiplex high-speed system.

1,548,952. ELECTRIC CONTROL CIRCUITS; J. Mills, Wyoming, N. J. App. filed Nov. 4, 1921. To suppress variations in a source of direct current.

1,548,953. ELECTRICAL HEATING DEVICE; A. A. Nims, Bloomfield, N. J. App. filed March 15, 1924. For heating containers.

1,548,959. CONTROL REGULATOR; H. M. Stoller, Mountain Lakes, N. J., and E. R. Morton, New York, N. Y. App. filed July 3, 1924. For a motor-generator set.

1,549,005. ELECTRIC POWER SYSTEM; J. J. Kane, Milwaukee, Wis. App. filed Feb. 2, 1920. Variable loads, especially where there is a tendency for the generator driving means to operate at a speed dependent upon the load.

1,549,009. STARTING SWITCH FOR SINGLE-PHASE MOTORS; R. C. Leake, Rochester, N. Y. App. filed June 7, 1920. Centrifugal switch.

1,549,016. ELECTRIC CIRCULATION FLUID HEATER; C. D. McLean, Berlin, New Hampshire. App. filed July 7, 1923.

1,549,032. TREE TELEPHONY AND TELEGRAPHY; G. O. Squier, Washington, D. C. App. filed Aug. 8, 1919. Radio transmission and reception through the use of trees, plants and the like.

1,549,040. ELECTRIC TOASTER; F. E. Wolcott, Hartford, Conn. App. filed Dec. 19, 1924. With reversible holders.

1,549,045. ELECTRIC ILLUMINATING AND STARTING PLANT FOR POWER VEHICLES; M. Rall, Stuttgart; H. Conzelmann, Stuttgart-Gablenberg, and H. Pflichthofer, Stuttgart, Germany. App. filed May 18, 1922.

1,549,119. IGNITION MAGNETO; W. W. Hawkins, Brooklyn, N. Y. App. filed March 11, 1922.

1,549,132. ELECTRIC HORN; E. A. Graham, Brockley, London, England. App. filed March 2, 1921. Vibrating plate or diaphragm type.

1,549,183. RADIO SIGNALING APPARATUS; G. H. Clark, Brooklyn, N. Y. App. filed Feb. 23, 1921. With radio-telegraph transmitters of the arc generator type.

1,549,184. INTERRUPTING DEVICE; G. H. Clark, Brooklyn, N. Y. App. filed July 1, 1922. For preventing the sending key of a relay for transmitting radio signals from sticking.

1,549,200. SEARCHLIGHT-ELECTRODE-CONTROLLING MECHANISM; A. C. Maby, Richmond Hill, N. Y. App. filed April 1, 1918.

1,549,211. ELECTRIC SWITCH; W. V. Palevich, Erie, Pa. App. filed July 23, 1923. For use in controlling lamps.

1,549,233. SECTIONAL ANODE; Van Winkle Todd, Millburn, N. J. App. filed Dec. 20, 1923. For use in electroplating apparatus.

Financial and Corporate

Utility Market Dull

Most Shares Suffer Further Recessions —Offerings in Smaller Volume than Previously

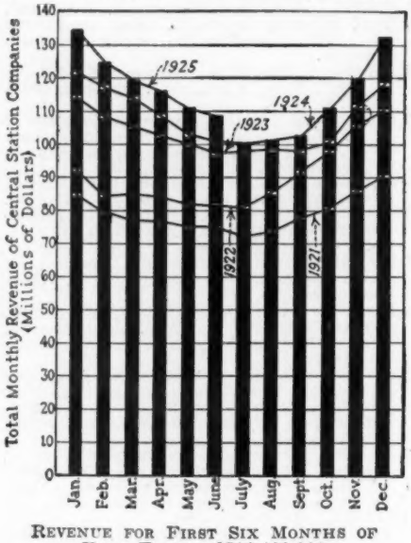
THE process of correcting the overbought condition which had been created by the active demand for shares in the spring and early summer months was continued in the public utility market this week. Desultory selling again held sway, and the trend of values was definitely toward lower levels. An encouraging sign, however, was the further shrinkage in volume of business, which was taken to indicate that the bulk of liquidation had been completed and the position of the market thereby materially improved.

Developments in the industry during the period under discussion were not of a character to influence prices to any great extent. Several of the leading companies put forth earnings statements for June and July which, to say the least, were distinctly satisfactory from a stockholder standpoint. Negotiations for the changing of control of a few small properties were brought to successful conclusion, and prospects were brightened for early announcement on deals known to be under consideration involving certain large properties.

American Light & Traction, in which the United Light & Power Company is a large stockholder, was the strongest feature of the week, attaining new record high levels. Strength here, however, was offset by moderate recessions in a number of other issues, including American Power & Light, Southeastern Power & Light, Georgia Railway & Light and Lehigh Power Securities. Like the unlisted shares, utility stocks dealt in on the New York Stock Exchange and on the curb market were subjected to a certain amount of liquidation.

Revenue 8.5 per Cent Over Last Year

Reports received by the ELECTRICAL WORLD from central-station systems representing 77 per cent of the generator rating of the industry indicate



REVENUE FOR FIRST SIX MONTHS OF YEAR TOTALS $716,400,000

that the total gross revenue from the sale of energy during the first six months of the year was $716,400,000, an increase of $57,000,000, or 8.5 per cent, over the same period for 1924. If this rate of increase is maintained during the last half of the year, the gross revenue of the industry for 1925 should total around $1,470,000,000. Notwithstanding this material gain in revenue, however, the revenue of the industry has been several per cent below the estimated normal for the period, based upon operations of the industry during the past five years.

The operating and maintenance expenses for the period totaled $315,000,000, a gain of 6.1 per cent over 1924. The gross revenue for June totaled $109,400,000, or a daily average of $3,650,000, an increase of 9.2 per cent over June of last year. During June the gross revenue was 3.2 per cent below the estimated normal for the month, based upon the operations of the industry during the past five years. The operating expenses during June totaled $51,300,000, a gain of 8.2 per cent over June of last year.

August Total Shows Slump

Electric Light and Power Companies of the Country Raise Only $47,525,000 by New Offerings

THE aggregate total of new financing by the central-station companies of the country during the month of August through the issue of stocks, bonds and notes amounted to $47,525,000, the smallest monthly total of the year with the exception of April, when $47,108,000 represented the sum which was realized from the sale of new securities.

The slack period recorded in late summer during previous years is evidence that the slump during the past month was not unusual. In 1924 the total fell from such amounts as $106,987,000 and

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN AUGUST

Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Eastern Texas Electric Co.*	$4,000,000	3	Gold notes	Construction and purchase of additional properties	5	98½	5.45
Quinte & Trent Valley Power Co. (Ont.)*	400,000	30	First mortgage sinking-fund gold bonds, series A	Construction	6	98½	6.13
Central Public Service Co.*	700,000	15	Collateral trust gold bonds, series A		6	95	6.52
Illinois Public Utility Co. (Ill.)*	1,800,000	1	Collateral trust gold notes		5	99	6.04
Jamaica Public Service Co., Ltd. (W.I.)*	200,000	..	Cumulative preferred stock		7	98½	7.10
Monongahela West Penn P. S. Co.	13,200,000	28	First lien and refunding mortgage gold bonds, series B	To pay cost of consolidation of properties	5½	98	5.65
Electric Investors, Inc. (Me.)	4,750,000	..	Preferred stock	Acquisition of additional securities and other corporate purposes	6	95	6.30
International Utilities Corp. (Md.)	2,375,000	..	Cumulative preferred stock	Acquisition of additional securities and other corporate purposes	7	95	7.36
National Electric Power Co.	2,000,000	..	Cumulative preferred stock	New capital	7	95	7.36
Laclede Gas Light Co. (Mo.)	3,000,000	10	Gold notes	To reimburse for additions and betterments heretofore made and to provide funds for capital expenditures	5½	98½	5.70
Consolidated Power & Light Co. (S. D.)	1,900,000	1	Mortgage lien gold notes	To retire outstanding notes and to reimburse treasury for expenditures on acquisition of additional properties	6	100	6
Southeastern Power & Light Co. (Me.)	10,000,000	100	Gold debentures, series A	Retiring notes and for other corporate purposes	6	96½	6.20
United Light & Power Co. (Md.)	2,820,000	..	Cumulative class A preferred stock, first series	New capital	6½	94	6.90
Western Public Service Co. (Col.)	480,000	..	First preferred cumulative stock	Refunding and other corporate purposes	7	96	7.29
Central States Electric Corp.	3,000,000	..	Cumulative preferred stock	Refunding and corporate purposes	7	98	7.22
Mississippi Power Co.	4,000,000	30	First and refunding mortgage gold bonds	Construction	5	92½	5.50
Total	$47,525,000						

* July issue. Not included in total.

$93,753,500 for earlier months to $84,052,000 in August, and in 1923 from $65,718,800 and $95,172,750 to $48,507,800 in August. The present year for the eight-months period shows a total of $727,057,010 as compared with $635,312,700 for the same period last year.

It is interesting to note the conspicuous part taken by preferred stock in the month's activities. Out of eleven new offerings six were preferred-stock issues. The largest individual piece of financing was done by the Monongahela West Penn Public Service Company in the form of first lien and refunding mortgage bonds to the amount of $13,200,000, the price being 98 to yield 5.65 per cent. The average yield, which advanced from 6 per cent in June to 6.15 per cent in July, continued on the upgrade, reaching the 6.18 mark. Long-term financing predominated.

Financial Structures Compared

Knowledge of Fundamental Differences Between Utilities and Industrial Firms Necessary to Fullest Utilization of Banking Resources

By H. A. Fountain
Treasurer Ohio Public Service Company, Cleveland, Ohio

UTILITY executives frequently find bankers indifferent to proposals based on balance sheets and operating statements prepared in accord with general practice. This attitude of the banker is due in large part to the marked difference between the financial structures of the public utility and the industrial corporation and to the fact that the banker, being familiar with the industrial statement, is prone to use it as a yardstick by which he measures the statement of the utility. An understanding of the fundamental differences between the financial structures of the utility and the industrial is a prerequisite to the fullest utilization of the utility's banking resources. The following analysis brings out seven fundamental differences in the financial structure and operating conditions of utilities and industrials and is based on the reports of sixteen utilities and more than eighty-five industrials.

This analysis involves utilities whose combined capital aggregates $996,854,455 and whose gross earnings for 1924 amounted to $157,002,560. Table I is a statement of the financial structure in per cent of total assets, and the tables following show ratios between industrials and utilities with respect to the structural elements shown in Table I.

General conclusions which may be drawn from this study are: The financial structure of utility companies is entirely different from that of industrial companies. For example, in public utilities, current assets are relatively about 15 per cent of those in industrials, fixed property investment about 200 per cent, deferred assets about 40 per cent, current liabilities about 30 per cent, long-term borrowings about 350 per cent, deferred liabilities about 30 per cent, and net worth about 70 per cent. The ratio of current assets to current liabilities is approximately 40 per cent of that prevailing for industrial companies. The ratio of long-term borrowings to fixed property investment is about one and three-quarters times as high as in industrials. This may be regarded as a tribute to the freedom from fluctuation inherent in the earnings situations of utility companies. Utilities being natural monopolies, subject to state regulation and serving necessities to ever-growing populations, rightfully enjoy the long-term credit standing evidenced by the high percentage of bonds outstanding as related to value of physical properties.

For every dollar of increased annual sales utilities must spend approximately $5 for fixed property, while industrials spend only 50 cents. This is one reason why the ratio of current assets to current liabilities is low. The extra-heavy construction requirements result in relatively large current accounts payable for materials, labor, etc., used not in operations but in adding to plant. Through the creation of these current liabilities assets are created, but not current assets, and the ratio consequently is lowered.

Utilities turn over total assets only about 22 per cent as rapidly as industrials, mainly because fixed-property investment, which turns over only about one-tenth as rapidly, constitutes such a large part of utility total assets.

While Table VI, strictly speaking, does not reflect rapidity of movement of materials in stock, and while relatively large portions of materials in utilities' stocks are for construction purposes and merchandise sales, it is felt that nevertheless the comparison as shown, revealing a turnover approximately three times as rapid as in industrial enterprises, may serve to emphasize the fact that inventories with utility companies are items of relative importance. Low inventories contribute to low current assets and tend to keep the ratio of current assets to current liabilities low.

The turnover of accounts receivable is about equal to that of industrial companies. This is due to deferred payments on sale of securities of the public utility companies being included in accounts receivable. If security-sales accounts receivable were to be excluded, the turnover for public utilities would be about twice that of industrial companies. In other words, the utility business is conducted more nearly on a cash basis. Because of this relatively low current accounts receivable contribute to relatively low current assets

TABLE I—THE FINANCIAL STRUCTURE IN PER CENT OF TOTAL ASSETS

	227 Industrials					16 Public Utilities		
	1917	1918	1919	1920	1921	1922	1923	1924
Current assets	42.0	45.0	45.0	44.0	38.0	7.1	6.4	7.2
Fixed property investment	45.0	43.0	43.0	44.0	48.0	88.3	88.7	88.6
Deferred assets	13.0	12.0	12.0	12.0	14.0	4.6	4.9	4.2
Current liabilities	15.0	17.0	16.0	16.0	10.0	4.7	6.5	5.2
Long-term borrowing	12.0	12.0	11.0	12.0	14.0	46.5	45.7	47.3
Deferred liabilities	4.0	4.0	4.0	3.0	5.0	1.3	1.1	1.0
Net worth	69.0	67.0	69.0	69.0	71.0	47.5	46.7	46.5

TABLE II—WORKING CAPITAL RATIO
(Ratio of current assets to current liabilities)

	1917	1918	1919	1920	1921	1922	1923	1924
241 industrials	2.83	2.68	2.75	2.77	3.56	....	....	....
16 public utilities	....	....	....	....	....	1.51	0.99	1.38

TABLE III—RATIO LONG-TERM BORROWING TO FIXED-PROPERTY INVESTMENT

	1917	1918	1919	1920	1921	1922	1923	1924
227 industrials	0.27	0.28	0.26	0.27	0.29	....	....	....
16 public utilities	....	....	....	....	....	0.53	0.52	0.53

TABLE IV—TURNOVER OF FIXED-PROPERTY INVESTMENT
(Stated in dollars of sales per dollar of fixed-property investment)

	1917	1918	1919	1920	1921	1922	1923	1924
94 industrials	1.97	2.18	1.99	1.98	1.25	....	....	....
16 public utilities	....	....	....	....	....	0.23	0.22	0.21

TABLE V—TURNOVER OF TOTAL ASSETS
(Stated in dollars of sales per dollar of total assets)

	227 Industrials					16 Public Utilities		
	1917	1918	1919	1920	1921	1922	1923	1924
94 industrials	0.93	0.99	0.91	0.88	0.62	....	....	....
16 public utilities	....	....	....	....	....	0.19	0.19	0.18

TABLE VI—TURNOVER OF INVENTORIES
(Stated in dollars of sales per dollar of inventories)

	1917	1918	1919	1920	1921	1922	1923	1924
94 industrials	4.88	4.46	4.11	3.73	3.52	....	....	....
16 public utilities	....	....	....	....	....	10.70	9.51	10.18

TABLE VII—TURNOVER OF ACCOUNTS RECEIVABLE
(Expressed in average number of days' sales in accounts receivable)

	1917	1918	1919	1920	1921	1922	1923	1924
87 industrials	40	46	42	48	56	..	..	..
16 public utilities	..	..	..	..	..	42	41	40

TABLE VIII—PER CENT RATIO OF SURPLUS NET PROFITS (BALANCE AVAILABLE FOR DIVIDENDS AND RESERVES) TO SALES (GROSS EARNINGS)

	1917	1918	1919	1920	1921	1922	1923	1924
93 industrials	10.8	6.6	6.4	5.1	7.0*	....	....	....
16 public utilities	....	....	....	....	....	24.0	26.3	24.4

TABLE IX—PER CENT RATIO OF SURPLUS NET PROFITS TO NET WORTH

	1917	1918	1919	1920	1921	1922	1923	1924
122 industrials	16.3	10.5	5.6	7.5	2.0*	....	....	....
16 public utilities	....	....	....	....	....	9.9	10.9	9.5

* Loss.

and tend to keep the ratio of current assets to current liabilities low.

The percentage of surplus net profits earned on sales for public utilities is about four times that of industrial companies and is very much more uniform. The uniformity is a tribute to the nature of the utility business. The lower margin of profit, however, in industrials is a tribute to more rapid turnover of total capital employed in industrials, which, as has been observed, is about four and one-half times as rapid as in utilities.

The percentage of surplus net profits earned on net worth for public utilities is about equal to that of industrial companies and is very much more uniform. Here again is uniformity a tribute to the nature of utility business. The fact that over a period of years the return on net worth is about the same in each case demonstrates the soundness of the previous conclusion that slow turnover of total capital employed offsets high profit margins.

Electric Investors to Create New Stock.—The stockholders of Electric Investors, Inc., will vote September 18 on creating an authorized issue of 150,000 shares of $6 preferred stock of no par value and also on authorizing the directors or the executive committee to convert at any time any of the outstanding $7 preferred stock (no par value) into $6 preferred stock (no par value).

Seattle's Lighting Department Issues Annual Report.—The Department of Lighting of the city of Seattle reports operating revenue for the year ended December 31, 1924, of $2,901,797 as compared with $2,661,966 for the year 1923 and expenses totaling $1,406,755 against $1,193,,893 in the previous year. Plant additions in 1924 amounted to $2,833,219.

Dividends Declared

The quarterly dividends listed below were announced during the past week by electric light and power companies and electrical manufacturing companies:

Name of Company	Per Cent	When Payable
American Public Service, pf.	$1.75	Oct. 1
American Public Utilities, pr. pf.	$1.75	Oct. 1
American Public Utilities, pr. pf.	$1.50	Oct. 1
Baton Rouge Electric, com.	0.62½	Sept. 1
Cities Service, com †	‡	Oct. 1
Cities Service, com.‡	‡	Oct. 1
Cities Service, pf. & pf. B†	‡	Oct. 1
Consolidated Gas (N. Y.) pf.	0.87½	Nov. 2
Detroit Edison	2	Oct. 15
General Gas & Electric, com. A	0.37½	Oct. 1
General Gas & Electric, pf. A	$2	Oct. 1
General Gas & Electric, pf. B	$1.75	Oct. 1
Kansas City Pwr. & Light, 1st pf. A	1¾	Oct. 1
Louisville Gas & Electric, A and B	0.43¾	Sept. 25
Massachusetts Lighting, com.	0.75	Sept. 30
Montana Power, com.	1	Oct. 1
Montana Power, pf.	1¾	Oct. 1
National Public Service, com. A	0.40	Sept. 15
Niagara Falls Power, com.	0.50	Oct. 1
Niagara Falls Power, pf.	0.43¾	Oct. 15
Niagara, Lockport & Ont. Pwr., pf.	1¾	Oct. 1
North American, com.*	...	Oct. 1
North American, pf.	0.75	Oct. 1
Northwest Utilities, pr.ln.	$1.75	Oct. 1
Ohio Edison, 6% pf.	$1.50	Dec. 1
Ohio Edison, 6.6% pf.	$1.65	Dec. 1
Ohio Edison, 7% pf.	$1.75	Dec. 1
Ohio Edison, 6.6% pf. †	0.55	Oct. 1
Ohio Edison, 6.6% pf. †	0.55	Nov. 1
Ohio Edison, 6.6% pf.†	0.55	Dec. 1
Penn. Water & Power	2	Oct. 1
Portland Electric Power, 6% pf.	1½	Oct. 1
Portland Electric Power, pr. pf.	1¾	Oct. 1
Public Service of N. J., com.	$1.25	Sept. 30
Public Service of N. J., 8% pf.	2	Sept. 30
Public Service of N. J., 7% pf.	1¾	Sept. 30
Tenn Electric Power, 1st pf.	1¾	Oct. 1
Tenn. Electric Pwr, 2d pf.	1¾	Oct. 1
Chicago Fuse Manufacturing	0.62½	Oct. 1
Cramp (Wm.) & Sons, S. & E. B.	$1	Sept. 30
Walworth Manufacturing, com.	0.45	Sept. 15
Walworth Manufacturing, pf.	0.75	Sept. 30

*One-fortieth share of common stock.
† Monthly.
‡ Payable in common stock.

Mohawk-Hudson Elects Directorate.—The following members have been elected to the board of directors of the Mohawk-Hudson Power Corporation: Roger W. Babson, James C. Brady, Nicholas F. Brady, Charles S. Brewer, Anson W. Burchard, Floyd L. Carlisle, John N. Carlisle, Ledyard Cogswell, Jr., Arthur V. Davis, Francis E. Frothingham, Perry T. Hanscom, James T. Hutchings, William E. Lewis, H. Edmund Machold, Randal Morgan, Robert C. Pruyn, Charles B. Rogers, Charles S. Ruffner, Cornelius D. Scully, William I. Taber, Frank M. Tait, Paul Thompson and Owen D. Young.

Company Reports

The following statements of earnings were issued during the past week by electric light and power companies for the month of July:

Name of Company	Gross Earnings for July 1925	1924
Bangor Hydro-Electric	$119,416	$117,411
Baton Rouge Electric	63,934	53,346
Binghamton Lt., Heat & Pwr.	131,534	99,896
Blackstone Valley Gas & Elec.	369,737	337,210
Cape Breton Electric	36,872	51,777
Central Mississippi Val. Elec.	47,143	44,738
Cities Service	1,603,728	1,320,696
Columbia Gas & Electric	2,406,317	1,433,997
Columbus Electric & Power	201,607	169,017
Commonwealth Power	3,333,645	2,854,515
Consumers Power	1,560,500	1,334,690
Eastern Texas Electric	231,544	200,645
Edison Elec. Illum. (Brockton)	110,344	107,124
El Paso Electric	200,825	193,574
El. Lt. & Pwr. of Abington & Rockland	48,323	35,802
Florida Public Service	75,841	54,358
Galveston-Houston Electric	329,054	336,971
Idaho Power	257,760	253,558
Keokuk Electric	33,586	32,974
Key West Electric	20,670	18,778
Lowell Electric Light	109,534	104,572
Metropolitan Edison	671,097	600,716
Mississippi River Power	279,921	267,174
Nevada-California Electric	485,051	436,821
New Bedford Gas & Ed. Lt.	313,332	256,314
New Jersey Pwr. & Light	102,610	79,375
No. Carolina Public Service	144,148	137,744
Northern Ohio Pwr.	933,762	786,409
Northern Texas Electric	186,401	201,981
Pacific Power & Light	294,432	265,663
Paducah Electric	51,223	49,537
Penn Edison	229,457	230,566
Philadelphia Company	4,309,075	4,012,948
Portland Electric Power	893,871	860,350
Puget Sound Power & Light	1,001,492	964,714
Savannah Electric & Power	154,753	153,813
Sayre Electric	20,759	16,408
Sierra Pacific Electric	96,632	88,593
Southern California Edison	2,333,502	1,821,214
Tampa Electric	241,879	175,405
Tennessee Electric Power	915,104	733,458
United Gas & Electric	497,015	421,293

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated or preference value of stock is $100.)

Companies	Bid Price Saturday, Aug. 29	Low 1925	High 1925
STOCKS			
Abitibi Pwr. & Paper, com.—no par	g 65¼	62	75¼
Adirondack Pwr. & Lt.—7% pf.	99	98	106
Adirondack Pwr. & Lt.—8% pf.	108	103	115
Adirondack Pwr. & Lt., com.—50	85	31	98
Ala. Pwr., pf.	g102	....	....
Allis-Chalmers Mfg. pf.	106½	103½	108
Allis-Chalmers Mfg., com	g 87	71¼	89½
Amer. & Foreign Pwr., pf. 25% pd.	131¼	114¼	135
Amer. & Foreign Pwr., 7% pf.	g 90¼	87	94
Amer. Bosch Magneto, com.—no par	g 31	26¼	54¼
Amer. Elec. Pwr., pf.	c103	96	104½
Amer. Gas & Elec., 6% pf.—no par.	89	85	91
Amer. Gas & Elec., com.—no par.	75	70	85
Amer. Lt. & Trac., 6% pf.	100	93	101½
Amer. Lt. & Trac., com.	206	139	220
Amer. Pwr. & Lt., 6% pf.	93	84	91½
Amer. Pwr. & Lt., com.—no par.	53½	52	67
Amer. Pub. Serv., 7% pf.	88	88	94
Amer. Pub. Serv., com.	85	45	90
Amer. Pub. Utilities, 4% pf.	80	....	....
Amer. Pub. Utilities, 5% pf.	75	71	82
Amer. Pub. Utilities, 7% pf.	87	87	95
Amer. Pub. Utilities, com.	95	70	103
Amer. Superpwr., pf.—25	26¼	24½	26¼
Amer. Superpwr., Class A—no par.	36¼	26	39¼
Amer. Superpwr., Class B—no par.	36	27¼	41
Amer. Wtr. Wks. & Elec., 6% pf.	h 104	95	110½
Amer. Wtr. Wks. & Elec., 7% pf.	98½	97	103
Amer. Wtr. Wks. & Elec., com.	g 60¼	34¼	68½
Appalachian Pwr., 7% pf.	98	92	100
Appalachian Pwr., 1st pf., 7%	100	95	101
Appalachian Pwr., com.—no par	78	70	83
Arizona Pwr., 7% pf.	78	75	87
Arizona Pwr., com.	25	15	33
Arkansas Lt. & Pwr., 7% pf.	98½	92	102
Arkansas Lt. & Pwr., com.	100	65	101
Asheville Pwr. & Lt., 7% pf.	101¼	101	102½
Assoc. Gas & Elec., 7% pf.—1% extra—50	g 52	....	....
Assoc. Gas & Elec., pf.—$6—no par	84	....	....
Assoc. Gas & Elec., Class A	g 38¾	....	....
Babcock & Wilcox, com.	g145	....	....
Blackstone Valley Gas & Elec., com.—50	92	....	....
Brazilian Trac., Lt. & Pwr., com.	f69¼	....	....
Broad River Pwr., pf.	92	90	97
Brooklyn Edison, com.	g137	120½	140½
Buffalo Gen. Elec., com.	65	44	73¼
Carolina Pwr. & Lt., pf.—$7—no par	104	100	107
Carolina Pwr. & Lt., com.	390	290	430
Central Ariz. Lt. & Pwr., pf.	100	100	106
Central Ark. Ry. & Lt., 7% pf.	97	91	98½
Central Ill. Pub. Serv., 6% pf.	85	84	93
Central Ind. Pwr., 7% pf.	89	88	95
Central Pwr. & Lt., pf.	90	88	95
Central States Elec., 7% pf.	96	87	98
Central States Elec., com.	140	70	102
Cincinnati Gas & Elec., com.	88	82	90
Cities Service, 6% pf.	83	80	84
Cities Service, pf. B—10	7¼	....	....
Cities Service, pf. BB—100	80	....	....
Cities Service, com.	38½	34	43
Cities Service, Bks. Shrs.	19	16½	22
Cleveland Elec. Illg., 6% pf.	102	101	105
Cleveland Elec. Illg., com.	240	200	250
Colorado Pwr., 7% pf.	95	93	98
Columbia Gas & Elec., 7% pf.	109½	104½	110½
Columbia Gas & Elec., com.—no par	g 72¼	45¼	75¼
Columbia Ry., Gas & Elec., 6% pf.	90	90	90
Columbus Elec. & Pwr., 2d pf.	g101	....	....
Columbus Elec. & Pwr., com.	g153	....	....
Columbus Ry., Pwr. & Lt., pf. A	93	86	99
Columbus Ry., Pwr. & Lt., pf. B	83	80	85
Columbus Ry., Pwr. & Lt., com.	150	114	150
Commonwealth Edison, com.	a136½	130½	141½
Commonwealth Pwr., 6% pf.	81	80	85½
Commonwealth Pwr., com—no par.	130	106	173
Conn. Lt. & Pwr., 8% pf.	115	115	118
Conn. Lt. & Pwr., 7% pf.	106	105	110
Cons. Gas of N. Y., pf.	g 56¼	....	....
Cons. Gas of N. Y., com—no par	g 88	74¼	92¼
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	c103½	102	104
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	c110¼	105	110½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	109	108	112
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	124	123	126
Cons. Gas, Elec. Lt. & Pwr. of Balti., com.—no par.	44	32	45
Cons. Utilities of Dela., 7% pf.	85	80	84
Consumers Pwr., 6% pf.	94½	90	97
Consumers Pwr., 6 6% pf.	98	97	102
Continental Gas & Elec., 7% ptc. pf	90	85	97
Continental Gas & Elec., 7% pr. pf.	95	89	95
Continental Gas & Elec., com.	135	77	145
Dayton Pwr. & Lt., 6% pf.	93	88	100
Dayton Pwr. & Lt., com.	400	180	460
Detroit Edison, com.	g130½	110	134½
Dubilier Condenser & Radio, com.	g 17½	....	....
Dubuque Elec., 6% pf.	90	80	90
Duquesne Lt., 7% pf.	109½	105	111½
East. Tex. Elec., 6% pf.	100	100	105
East. Tex. Elec., com.	68	70	75½
Edison Elec. Illum. of Boston, com.	d201	200	213
El Paso Elec., com.	g 74	....	....
El Paso Elec., pf.	g100	....	....
Elec. Bond & Share, 6% pf.	g104	104	105½
Elec. Bond & Share Sec., com.—no par	g 65	64½	65¾

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal. gBid price, low and high, Tuesday, Sept. 1. hLatest quotations available.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday, Aug. 29	Low 1925	High 1925
STOCKS—Continued			
Elec. Investors, 7% pf.	93	90	100
Elec. Investors, com.	58	30	66
Elec. Investors, 10% pd. receipts	39	15	48⅛
Elec. Pwr. & Lt., ctfs, pf.	g 90	89½	94
Elec. Pwr. & Lt., ctfs., 40% pd.	g105	100	110
Elec. Pwr. & Lt., ctfs., com.	g 32½	17⅛	40½
Elec. Storage Battery, com.—no par	g 64½	60⅛	70⅛
Elmira Wtr., Lt. & R.R., 7% pf.	94	93	98
Empire Dist. Elec., 6% pf.	78	78	85
Engr. Pub. Serv., pf.	100	100	103
Engr. Pub. Serv., com.—no par	25	23	30
Eureka Vacuum Cleaner, com.—no par	48	46	52½
Fairbanks Morse, com.	46	32½	49⅞
Federal Lt. & Trac., com.	g 27½	26⅛	36
Federal Utilities, pf.	g 75	....	....
Federal Utilities, com.	g 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	g102	101½	103
Galveston-Houston Elec., 6% pf.	68	70	75
Galveston-Houston Elec., com.—no par	20	32	40
Gen. Elec., com.	323½	227½	337½
Gen. Elec., special—10	g 11⅛	11	11⅛
Gen. Gas & Elec., 6% pf.	230	72	240
Gen. Gas & Elec., 7% pf.	150	120	....
Gen. Gas & Elec., pf.—$7—no par	145	90	175
Gen. Gas & Elec., pf.—$8—no par	153	104½	180
Gen. Gas & Elec., com.	220	72	240
Ga. Lt., Pwr., & Rys., 6% pf.	80	74	85
Ga. Lt., Pwr. & Rys., com.	65	25	74
Ga. Ry. & Elec., 5% pf.	80⅛	78	79⅛
Ga. Ry. & Elec., com.	d118⅛	115½	115⅛
Ga. Ry. & Pwr., 8% pf.	g112	....	....
Ga. Ry. & Pwr., 7% pf.	g101	....	....
Ga. Ry. & Pwr., 4% pf.	107	62	110
Ga. Ry. & Pwr., com.	110	62	114
Gt. Western Pwr., 7% pf.	99	....	....
Havana Elec. Ry., Lt. & Pwr., com.	g 223	112	234
Hurley Machine, com.—no par	a 49½	41⅛	56
Ill. No. Utilities, 6% pf.	88	82	92
Ill. Pwr. & Lt., 7% pf.	95½	92⅛	98
Int. Combustion Engr., com.—no par	g 47⅛	31⅛	51
Int. Utilities, class A—no par	34	34	46½
Int. Utilities, class B—no par	g 10½	....	....
Jersey Central Pwr. & Lt., 7% pf.	96	90	96
Jersey Central Pwr. & Lt., com.	45	15	50
Johns-Manville, com.—no par	g170½	....	....
Kansas Gas & Elec., 7% pf.	g102	101½	103
Kelvinator Corp., com.—no par	g 43½	....	....
Kentucky Hydro-Elec., com.	a 92½	85⅛	92⅛
Kentucky Sec., 6% pf.	67	67	78
Kentucky Sec., com.	78	77	87
Kings County Ltg., 7% pf.	g100	....	....
Laclede Gas Lt., com.	g156	110½	178
Lehigh Pwr. Sec., com.—no par	125	82	155
Long Island Ltg., 7% pf.	103	100	105
Long Island Ltg., com.	105	60	105
Los Angeles Gas & Elec., 6% pf.	94	90	97
Manila Elec., com.—no par	38⅛	28⅛	49½
Maytag Mfg., com.	g 21⅛	....	....
Metropolitan Edison, 6% pf.	95	95	96
Middle West Utilities, 7% pf.	96	90	100
Middle West Utilities, 7% pr. lien pf.	105	98	108
Middle West Utilities, com.—no par	a103⅛	82½	125
Midland Utilities, pr. ln. pf.	a100½	98⅛	101
Milwaukee Elec. Ry. & Lt., 8% pf.	100	98	105
Milwaukee Elec. Ry. & Lt., 7% pf.	97⅛	96	105
Milwaukee Elec. Ry. & Lt., 6% pf.	86⅛	83½	87
Minn. Pwr. & Lt., 7% pf.	g100	100	101
Miss. Pwr. & Lt., pf.	g100	....	....
Miss. River Pwr., 6% pf.	90	87⅛	94
Miss. River Pwr., com.	60	37	68
Montana Pwr., com.	g 85⅛	64	99½
Montreal Pwr., com.	f 208½	....	....
Mountain States Pwr., pf.	g 93	....	....
MountainStates Pwr., com.	g 27	....	....
National Elec. Pwr., com.	62	40	65
National Lt., Ht. & Pwr., com.—no par	11	11	....
National Pwr. & Lt., pf., $7—no par	98	95	99
National Pwr. & Lt., com.—no par.	335	185	357
National Pub. Serv., 7% pf.	g 98	....	....
National Pub. Serv., A com.—no par	g 25⅜	....	....
National Pub. Serv., B com.—no par	g 17⅛	....	....
Nebraska Pwr., 7% pf.	g102⅛	102	103½
Nevada-Calif. Elec., com.	33	32⅛	50⅛
N. J. Pwr. & Lt., 7% pf.	102	92	102
New Orleans Pub. Serv., 7% pf.	97	94	102
New Orleans Pub. Serv., com.—no par	33	31	38⅛
N. Y. Central Elec., 7% pf.	100	96	101
Niagara Falls Pwr., 7% pf.—25	28	27⅛	29
Niagara Falls Pwr., com.—no par	h 70	45⅛	77
Niagara, Lock. & Ont. Pwr., 7% pf.	106	101⅛	110
Niagara, Lock. & Ont. Pwr., com.—no par	65	60	73
Nizer Corp., A.—no par	g 60⅛	....	....
Nizer Corp., B.—no par	g 59⅛	....	....
No. Amer., 6% pf.—50	f 50	46⅛	50⅛
No. Amer., com.—50	g 58½	41⅛	60⅛
No. Caro. Pub. Serv., pf.—$7—no par	91	90	96
No. N. Y. Utilities, 7% pf.	g101	....	....
No. Ohio Pwr., com.	10⅛	5	13⅛
No. Ohio Trac. & Lt., 6% pf.	73	64	75
No. Ont. Lt. & Pwr., pf.	78	68	78
No. Ont. Lt. & Pwr., com.	47	41	52
No. States Pwr., 7% pf.	100	95	100
No. States Pwr. com.	115	103	125
No. Texas Elec., 6% pf.	55	60	75
No. Texas Elec., com.	40	40	70
No. West Utilities, pf.	92½	90	95
Ohio Gas & Elec., 7% pf.	90	87	100
Ohio Pwr., 6% pf.	91	85	95
Ohio Pub. Serv., 7% pf.	97	97	100
Oklahoma Gas & Elec., pf.	g 93	....	....
Pacific Gas & Elec., 6% pf.	95	92	99
Pacific Gas & Elec., com.	g111⅛	102½	118⅛
Pacific Pwr. & Lt., 7% pf.	g101⅛	101	102⅛
Parr Shoals Pwr., 6% pf.	92	90	100
Penn Central Lt. & Pwr., pf.—no par	70	60	70⅛
Penn-Ohio Elec., 7% pf.	95	83⅛	96
Penn-Ohio Pwr. & Lt., 7% pf.	93	91	100
Penn-Ohio Pwr. & Lt., 8% pf.	103	101	110
Penn Pwr. & Lt.—$7—no par	g103⅛	103	104½
Penn Pub. Serv., 7% pf.	90	90	100
Penn Pub. Serv., 6% pf.	80	80	90
Penn Wtr. & Pwr., com.	165	120	178
Phila. Co., pf.—50	48⅛	45⅛	49
Phila. Co., com.	g 58	51⅛	62⅛
Phila. Elec., com.	c 46⅛	37⅛	49⅛
Pittsburgh Utilities, pf.	14½	12⅛	17⅛
Portland Elec. Pwr., 7% pf.	98	95	99
Portland Elec. Pwr., 6% pf.	67	70	80
Portland Elec. Pwr. com.	35	40	53
Portland Ry., Lt. & Pwr., pf.	g 72	....	....
Portland Ry., Lt. & Pwr., com.	g 41	....	....
Pwr. Corp. of N. Y., 7% pf.	99	96	102
Pwr. Corp. of N. Y., com.—no par	72	15	80⅛
Pwr. Sec., pf.	30	30	55
Pwr. Sec., com.	15	8	30
Pub. Serv. of N. J., 7% pf.	g105	99	105
Pub. Serv. of N. J., 8% pf.	g115⅛	109	115⅛
Pub. Serv. of N. J. com—no par	g 82⅛	62⅛	87⅛
Pub. Serv. of No. Ill., 6% pf.	108	90	97
Public Serv. of No. Ill., 7% pf.	a108⅛	102	110⅛
Pub. Serv. of No. Ill., com.—no par	125	97	124
Pub. Serv. of Okla., 7% pf.	94	87	95
Pub. Serv. Elec. & Gas, 6% pf.	g 97⅛	92⅛	97⅛
Puget Sound Pwr. & Lt., 7% pf.	102	102½	107
Puget Sound Pwr. & Lt., 6% pf.	g 84⅛	....	....
Puget Sound Pwr. & Lt., com.	53	49	61
Radio Corp. of Amer., pf.—50	49⅛	48⅛	54
Radio Corp. of Amer., com.—no par	g 54⅛	8⅛	77⅛
Republic Ry. & Lt., pf.	79	70	85
Republic Ry. & Lt., com.	64	49	65
Rochester Gas & Elec., 5% pf.	105	80	98
Servel Corp., Class A	g 30⅛	....	....
Sierra Pacific Elec., com.	g 16⅛	....	....
Sioux City Gas & Elec., 7% pf.	g 99	....	....
Southeastern Pwr. & Lt., 7% pf.	97	90	100
Southeastern Pwr. & Lt., com.	140	45	158
So. Calif. Edison, 8% pf.	123	115	128
So. Calif. Edison, 7% pf.	109	105	107½
So. Calif. Edison, 6% pf.	95	90	95½
So. Calif. Edison, com.	120	102	139
Southern Cities Utilities, 7% pf.	82	77	100
Southern Cities Utilities, com.	54	30	71
Southern Pwr. & Lt. of Md., pf.	g107	....	....
Southern Pwr. & Lt. of Md., com.	g 32	....	....
Southwestern Gas & Elec., pf.	97½	92⅛	97⅛
Southwestern Pwr. & Lt., A	g 47	....	....
Southwestern Pwr. & Lt., B	g 22⅛	....	....
Southwestern Pwr. & Lt., 7% pf.	98	90	102
Springfield (Mo.) Ry. & Lt., 7% pf.	92	92	93
Standard Gas & Elec., 8% pf.	g 53⅛	50⅛	55⅛
Standard Gas & Elec., 7% pf.	98⅛	96	100
Standard Gas & Elec., com.—no par	g 53	40⅛	59⅛
Standard Pwr. & Lt., 7% pf.	109	95	114⅛
Tampa Elec., com.	g230	....	....
Tenn. Elec. Pwr., 6% pf.	85	80	85
Tenn. Elec. Pwr., 7% pf.	98	93	103
Tenn. Elec. Pwr., pf.—$6—no par.	80	72	84
Tenn. Elec. Pwr., com.—no par.	60	47	69
Tex. Pwr. & Lt., 7% pf.	g102⅛	102	104
Tide Water Pwr., 8% pf.	g 98	....	....
Timken Roller Bearing, com.	g 42⅛	37⅛	46⅛
Toledo Edison, 8% pf.	110	109	114
Toledo Edison, 7% pf.	100	94	101⅛
Toledo Edison, com.	25	21	25
Tri-City Ry. & Lt., 6% pf.	85	82	85
United Gas & Elec., 5% pf.	91	80	94
United Gas & Elec., com.—no par.	40	26	49
United Gas & Elec. (N. J.), 5% pf.	62	55	65
United Gas Impr. 50	c 98	79⅛	100⅛
United Lt. & Pwr., pf.—$4—no par	50	41	51
United Lt. & Pwr., pf.—$6.50—no par	93	83	99
United Lt. & Pwr., com., A—no par.	125	42	138
United Lt. & Pwr., com., B—no par.	150	49	100
Utah Pwr. & Lt., 7% pf.	g100⅛	100	101⅛
Utica Gas & Elec., 7% pf.	101	100	104
Utica Gas & Elec., com.	200	100	200
Utilities Pwr. & Lt., 7% pf., ctfs.	g 98	....	....
Utilities Pwr. & Lt., com. B—no par	16	12	20
Vermont Hydro-Elec., 7% pf.	90	87	96
Virginia Pwr., 7% pf.	101	94	107
Virginia Pwr., com.	65	65	92
Virginia Ry. & Pwr., com.	h123⅛	64⅛	123⅛
Wagner Elec., pf.	b 88	79	91
Wagner Elec., com.	b 39	26⅛	50
Washington Wtr. Pwr., com.	129	110	140
West Mo. Pwr., 7% pf.	94	....	....
West Penn., 7% pf.	97⅛	94	100
West Penn. com.	110	105	145
West Virginia Lt., Ht. & Pwr., 7% pf.	94	94⅛	96⅛
West Va. Utilities, 7% pf.—50	38	38	47
Western Elec., 7% pf.	110⅛	110	117⅛
Western Pwr., 7% pf.	88	84	95⅛
Western Pwr., com.—no par	61	34	68
Western States Gas & Elec., 7% pf.	89	82	92
Western States Gas & Elec., com.	g 19	....	....
Westinghouse Elec. & Mfg., com.—50	g 75	66⅛	84
Weston Elec. Instrument, cl. A	g 27	19⅛	27
Weston Elec. Instrument, com.	g 19	9⅛	20⅛
Wis.-Minn. Lt. & Pwr., 7% pf.	90	92	95
Wis. Pwr., Lt. & Ht., 7% pf.	85	85	90
Worthington Pump, pf. A	74⅛	77	88
Worthington Pump, pf. B	61	58	76⅛
Worthington Pump, com.	38⅛	35⅛	79⅛
Yadkin River Pwr., 7% pf.	g102	102	103⅛
Yale & Towne, com.—25	g 65	63	70⅛

BONDS

Companies			Bid Price Saturday Aug. 29	Low 1925	High 1925
Adir. Elec. Pwr.	5s	1962	99	97⅛	100⅛
Adir. Pwr. & Lt.	6s	1950	104⅛	102⅛	105⅛
Adir. Pwr. & Lt.	5s	1930	95	94	97⅛
Ala. Pwr.	5s	1946	98⅛	96	100⅛
Ala. Pwr.	5s	1951	95⅛	92⅛	97
Ala. Pwr.	6s	1951	104⅛	101⅛	105⅛
Ala. Trac. Lt. & Pwr.	5s	1962	100⅛	86	99⅛
Aluminum Co. of Amer.	7s	1933	107	106⅛	107⅛
Amer. Gas & Elec.	5s	2007	92⅛	90	93⅛
Amer. Gas & Elec.	6s	2014	97⅛	96⅛	98
Amer. Pwr. & Lt.	6s	2016	96⅛	94	98⅛
Amer. Pub. Serv.	6s	1942	98	94	99⅛
Amer. Wtr. Wks. & Elec.	5s	1934	95⅛	92⅛	98
Anaconda Copper	6s	1929	103	102⅛	104
Anaconda Copper	6s	1953	100⅛	99⅛	102
Anaconda Copper	7s	1938	101⅛	99⅛	104
Appalachian Pwr.	5s	1941	97⅛	96	99⅛
Appalachian Pwr.	6s	2024	91⅛	86⅛	94⅛
Appalachian Pwr.	7s	1936	105	105⅛	106⅛
Arizona Pwr.	6s	1933	99⅛	97⅛	101⅛
Arizona Pwr.	6s	1947	95⅛	90	96
Ark. Central Pwr.	6s	1948	102	98⅛	102⅛
Ark. Lt. & Pwr.	6s	1945	101⅛	100	104⅛
Ark. Lt. & Pwr.	6s	1954	96	92⅛	99⅛
Assoc. Gas & Elec.	6s	1965	g103⅛	....	....
Assoc. Gas & Elec.	6½s	1954	103	94⅛	106
Binghamton Lt., Ht. & Pwr.	5s	1946	97⅛	94⅛	98
Birmingham Elec.	6s	1954	101	99	103
Birmingham Ry., Lt., & Pwr.	4½s	1954	88	85	89⅛
Broad River Pwr.	6½s	1934	100⅛	99	102
Brooklyn Edison	5s	1949	101⅛	99⅛	103
Brooklyn Edison	6s	1930	105⅛	103⅛	105⅛
Buffalo Gen. Elec. 1st.	5s	1939	101⅛	100⅛	101⅛
Buffalo Gen. Elec. 1st & Ref.	5s	1939	100⅛	100	100⅛
Burlington Ry. & Lt.	5s	1932	94⅛	90	96
Butte Elec. & Pwr.	5s	1951	99⅛	99	100⅛
Calif. Gas & Elec.	5s	1937	100	98	101⅛
Canadian Lt. & Pwr.	5s	1949	40	36	62
Canton Elec.	5s	1937	99	99	100⅛
Carolina Pwr. & Lt.	5s	1938	99	98⅛	100⅛
Carolina Pwr. & Lt.	6s	1953	103⅛	103⅛	105
Cedar Rapids Mfg. & Pwr.	5s	1953	99⅛	98⅛	100⅛
Central Ark. Ry. & Lt.	5s	1928	98⅛	98⅛	100
Central Ga. Pwr.	5s	1938	95⅛	93	97
Central Ill. Lt.	5s	1943	97⅛	94	99⅛
Central Ill. Publ Serv.	5s	1952	88	84⅛	92⅛
Central Ill. Pub. Serv.	6s	1944	98	96⅛	101⅛
Central Ind. Pwr.	6s	1947	97⅛	95⅛	99⅛
Central Ia. Pwr. & Lt.	6s	1944	99	97	100⅛
Central N. Y. Gas & El.	5s	1941	95	94	97⅛
Central Pwr. & Lt.	6s	1946	101	97⅛	101⅛
Central Pwr. & Lt.	6½s	1952	100⅛	94	102
Central States Elec.	5s	1926	99	98	100⅛
Chattanooga Ry. & Lt.	5s	1956	84	81	85
Cincinnati Gas & Elec.	5s	1956	107⅛	98⅛	104⅛
Cincinnati Gas & Elec.	5½s	1967	103	101	105
Cities Service	6s	1966	90⅛	90⅛	91⅛
Cities Service	7s	B1966	176	150⅛	178⅛
Cities Service	7s	C 1966	124⅛	111	128
Cities Service	7s	D 1966	103	98⅛	106⅛
Cities Service Pwr. & Lt.	6s	1944	93	93⅛	95
City Lt. & Trac.	5s	1952	84	74	85⅛
Cleveland Elec. Illum.	5s	1939	101⅛	100	102
Cleveland Elec. Illum.	5s	1954	100	97⅛	101
Cleveland Elec. Illum.	7s	1941	110	109	111⅛
Colorado Pwr.	5s	1953	94	93	96⅛
Columbia Gas & Elec.	5s	1927	99⅛	99⅛	100⅛
Columbia Ry., Gas & El.	5s	1936	92	92⅛	94⅛
Columbus, Dela. & Marion Elec.	5s	1937	85	83	88
Columbus, Dela. & Marion Elec.	6s	1937	95	91	98
Columbus Elec. & Pwr.	6s	1947	g102	....	....
Columbus Ry., Pwr. & Lt.	5s	1940	96⅛	93⅛	98
Columbus Ry., Pwr. & Lt.	6s	1941	102	101⅛	105
Commonwealth Edison	5s	1943	101⅛	99⅛	102⅛
Commonwealth Edison	5s	1953	99	98⅛	101
Commonwealth Edison	5s	1954	99⅛	98	101
Commonwealth Pwr.	6s	1947	101⅛	97⅛	103⅛
Community Pwr. & Lt.	6s	1950	96	94⅛	98
Conn. Ry. & Ltg.	4½s	1951	g 90	....	....
Consol. Cities, Lt., Pwr. & Trac.	5s	1962	79⅛	75⅛	82⅛
Consol. Elec.	5s	1955	96⅛	94	98⅛
Consol. Gas of N. Y.	5½s	1945	g103⅛	....	....
Con. Gas, Elec. Lt. & Pwr. of Balti.	4½s	1935	97	95⅛	97⅛
Con. Gas, Elec. Lt. & Pwr. of Balti.	5½s	1952	104⅛	101⅛	105⅛
Con. Gas, Elec. Lt. & Pwr. of Balti.	6s	1949	c106	104⅛	107⅛
Con. Gas, Elec. Lt. & Pwr. of Balti.	5s	1965	g 99	....	....
Consumers Elec. Lt. & Pwr.	5s	1936	95	93	96⅛
Consumers Pwr.	5s	1936	99⅛	99	100⅛
Consumers Pwr.	5s	1952	96⅛	90⅛	100
Consumers Pwr.	5½s	1954	102	99	104⅛
Continental Gas & Elec.	5s	1927	99⅛	99⅛	100⅛
Continental Gas & Elec.	6s	1947	99⅛	98	101
Continental Gas & Elec.	6½s	1964	97⅛	96⅛	101
Continental Gas & Elec.	7s	1954	103	99	103½
Cumberland County Pwr. & Lt.	5s	1942	94	92	96⅛
Dallas Pwr. & Lt.	6s	1949	104	103	105⅛
Dayton Ltg.	5s	1937	99⅛	98⅛	100⅛
Dayton Pwr. & Lt.	5s	1941	99	97	100⅛
Defiance Gas & Elec.	5s	1942	92	88⅛	97⅛
Denver Gas & Elec.	5s	1949	98	97⅛	100
Denver Gas & Elec. Lt.	5s	1951	93	92	95⅛
Des Moines Elec.	5s	1938	98	98	100⅛
Detroit Edison	5s	1933	101⅛	99⅛	102⅛
Detroit Edison	5s	1940	102⅛	99⅛	102⅛
Detroit Edison	5s	1949	99⅛	97⅛	101⅛
Detroit Edison	5s	1955	99	97⅛	100
Detroit Edison	6s	1932	130	110⅛	133⅛
Detroit Edison	6s	1940	107⅛	106⅛	108⅛
Detroit Edison	7s	1930	130⅛	121⅛	133
Dominion Pwr. & Trans.	5s	1932	95	95⅛	98⅛
Dubuque Elec.	6s	1942	100⅛	97	101⅛
Duke-Price Pwr.	6s	1949	100	98⅛	103
Duquesne Lt.	6s	1949	106	104⅛	107⅛
Duquesne Lt.	5½s	1949	105	104	106
Durham Pub. Serv.	7s	1949	100	97⅛	101⅛
East Penn. Elec.	6s	1953	104	100⅛	105⅛
East Oregon Lt. & Pwr.	6s	1929	100	97⅛	100⅛
East. Tex. Elec.	5s	1942	g 96	....	....
Economy Lt. & Pwr.	5s	1956	98	96	99⅛
Edison Elec. Illum. of Brockton	4s	1939	92	89	95⅛
Edison Elec. Illum. (N. Y.)	5s	1995	102⅛	99⅛	103
El Paso Elec.	5s	1932	g102	....	....
El Paso Elec.	5s	1950	g 95⅛	....	....
Elec. Pwr. Corp. (Germany)	6½s	1950	87	86⅛	88⅛

Stock Exchange: cChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal. gBid price, low and high, Tuesday, Sept. 1. hLatest quotations available.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies		Bid Price Saturday, Aug. 29	Low 1925	High 1925
BONDS (Continued)				
Emira Wtr., Lt. & R.R.	5s 1956	95	92½	96½
Empire Dist. Elec.	5s 1949	90	86½	91½
Erie Ltg.	5s 1967	98	95½	99½
Evansville Gas & Elec. Lt.	5s 1932	98½	96	100
Federal Lt. & Trac.	5s 1942	91½	88	96½
Federal Lt. & Trac.	6s 1942	100½	96½	103
Federal Lt. & Trac.	6s 1954	91½	91	94
Ft. Smith Lt. & Trac.	5s 1936	79½	76½	82½
Ft. Worth Pwr. & Lt.	5s 1931	99	99	100½
General Elec.	3½s 1942	87	83	87
General Elec.	5s 1952	107½	101½	107½
Georgia Carolina Pwr.	5s 1952	87½	82	90
Ga. Lt., Pwr. & Rys.	5s 1941	88	86½	90½
Ga. Ry. & Elec.	5s 1932	98	98½	100½
Ga. Ry. & Elec.	5s 1949	92½	88	94½
Ga. Ry. & Pwr.	5s 1954	94½	89½	96
Ga. Ry. & Pwr.	6s 1947	102	100½	103½
Ga. Ry. & Pwr.	7s 1941	104½	105	107
German Gen. Elec.	7s 1945	93½	92	94½
Great Cons. Elec. Pwr. (Japan)	6½s 1950	86	86	86½
Great Cons. Elec. Pwr. (Japan)	7s 1944	89½	87½	91½
Great Falls Pwr.	5s 1940	101½	99½	102½
Great Northern Pwr.	5s 1935	98	96	99
Great Western Pwr.	5s 1946	98½	95	99½
Great Western Pwr.	6s 1949	100½	100	102½
Great Western Pwr.	6s 1952	101	99½	102½
Havana Elec. Ry., Lt. & Pwr.	5s 1954	94	85½	95½
Holtwood Pwr.	6s 1954	103	100	104½
Houston Ltg. & Pwr.	5s 1931	99½	98½	100
Houston Ltg. & Pwr.	5s 1953	94	90½	95½
Houston Ltg. & Pwr.	5½s 1954	100	97	101½
Hydraulic Pwr.	5s 1951	100½	99½	102
Hydraulic Pwr.	5s 1950	100½	100	103
Idaho Pwr.	5s 1947	94½	93	97½
Ill. Elec. Pwr.	6s 1943	102	99½	103½
Ill. Pwr.	5s 1933	93½	93	95½
Ill. Pwr. & Lt.	6s 1953	100½	100½	102½
Ill. Pwr. & Lt.	7s 1953	100½	99	102½
Ind. Elec.	6s 1947	99	98	98
Ind. Gen. Serv.	5s 1948	95	92	97½
Ind. Lighting	4s 1958	80½	78	83
Indiana & Mich. Elec.	5s 1957	96½	97½	99½
Ind. Pwr.	7½s 1941	105½	104	106
Ind. Service	5s 1950	89½	86½	92
Ind. Service	6s 2020	86½	73	88½
Ingersoll-Rand	5s 1935	99½	92	99½
Interstate Pwr.	6s 1944	97	95	99½
Interstate Pwr.	7s 1934	98½	97	100½
Interstate Pub. Serv.	6s 1948	98	96	100½
Iowa Ry. & Lt.	5s 1932	97½	97	99½
Kansas City Pwr. & Lt.	5s 1952	99	95½	101
Kansas Elec. Pwr.	6s 1937	99½	97½	102
Kansas Elec. Pwr.	6s 1943	99½	97½	102
Kansas Gas & Elec.	6s 1952	102½	98½	103½
Kansas Gas & Elec.	6s 2022	90	86½	94½
Kentucky Utilities	6s 1949	99	97	101½
Kings County Elec. Lt. & Pwr.	5s 1937	102½	99	103
Kings County Elec. Lt. & Pwr.	6s 1997	119½	114½	120½
Kings County Ltg.	5s 1954	98½	89	101½
Kings County Ltg.	6½s 1954	107	103½	108½
Knoxville Ry. & Lt.	5s 1946	92	88	95½
Laclede Gas Lt.	5s 1934	101	98½	101½
Laclede Gas Lt.	5½s 1953	99½	95½	102
Laurentide Pwr.	6s 1936	99	96	100
Laurentide Pwr.	5s 1946	99½	97	100½
Lehigh Pwr. Sec.	6s 1927	101	100½	101½
Lincoln Gas & Elec.	5s 1941	90	92½	95½
Long Island Ltg.	5s 1936	99	98½	100½
Long Island Ltg.	6s 1945	100	99½	102
Long Island Ltg.	6s 1948	103	102	105½
Los Angeles Gas & Elec.	5s 1939	98	98	101½
Los Angeles Gas & Elec.	5½s 1943	97½	94	99½
Los Angeles Gas & Elec.	5½s 1947	97½	96	99½
Los Angeles Gas & Elec.	5½s 1949	97	95½	99½
Los Angeles Gas & Elec.	6s 1942	100	101½	104½
Louisiana Pwr.	6s 1944	g98	....	....
Louisville Gas & Elec.	5s 1952	96½	90½	99½
Louisville Gas & Elec.	5½s 1954	101½	99	102
Lower Austrian Hydro-Elec.	6½s 1944	85½	85½	86½
Luzerne County Gas & Elec.	5s 1948	98	97	99½
Luzerne County Gas & Elec.	7s 1944	103	99½	104½
Luzerne County Gas & Elec.	6s 1954	101½	99	105
Madison River Pwr.	5s 1935	99	99½	101
Manila Elec.	7s 1942	102	97½	102½
Manila Elec. Ry. & Ltg.	5s 1953	90	85	92
Manitoba Pwr.	7s 1941	103½	98½	105½
Memphis Pwr. & Lt.	5s 1948	98	95	99½
Metropolitan Edison	6s 1952	104½	101½	106
Metropolitan Edison	5s 1953	94½	91½	97
Metropolitan Pwr.	6s 1953	100	100	104
Michigan Lt.	5s 1946	98	97½	100
Michigan No. Pwr.	5s 1941	96	95½	97
Milwaukee Elec. Ry. & Lt.	5s 1926	100	100	101½
Milwaukee Elec. Ry. & Lt.	4½s 1931	93½	95	96½
Milwaukee Elec. Ry. & Lt.	5s 1951	97½	94	100
Milwaukee Elec. Ry. & Lt.	5s 1961	89½	84½	92½
Milwaukee Elec. Ry. & Lt.	6s 1953	100½	98½	104
Minn. Pwr. & Lt.	6s 1950	103½	101½	105½
Miss. River Pwr.	5s 1951	99½	96½	100½
Miss. River Pwr.	7s 1935	103	102	104
Mobile Elec.	5s 1946	96	91	97½
Montana Pwr.	5s 1943	99½	97½	100½
Montgomery Lt. & Wtr. Pwr.	5s 1943	93	86½	93½
Montreal Lt., Ht. & Pwr.	4½s 1932	97	97	98½
Montreal Lt., Ht. & Pwr.	5s 1933	98½	98½	101
Montreal Pub. Serv.	5s 1942	93	89	94½
Mountain States Pwr.	6s 1938	98	96½	100½
Nashville Ry. & Lt.	5s 1953	96½	94	98
Nashville Ry. & Lt.	5s 1958	89	84	88½
Nassau Lt. & Pwr.	5s 1927	98	98	101
Nassau & Suffolk Ltg.	5s 1945	88	82	91
National Pwr. & Lt.	7s 1972	101	97	103½
Nebraska Pwr.	5s 1949	98½	97	99½
Nebraska Pwr.	6s 2022	95	89½	95½
Nevada-Calif. Elec.	6s 1946	98½	96½	100½
Nevada-Calif. Elec.	6s 1950	98½	96½	100½
New England Pwr.	5s 1951	101	100½	103
New Jersey Pwr. & Lt.	5s 1936	95	92½	97½
New Orleans Pub. Serv.	4½s 1935	86½	83½	88½
New Orleans Pub. Serv.	5s 1952	89	86½	94½
New Orleans Pub. Serv.	5s 1955	89½	89½	93
New Orleans Pub. Serv.	6s 1949	92	86½	93½
N. Y. & Queens Elec. Lt. & Pwr.	5s 1930	99½	99½	100½
N. Y. & Westchester Ltg.	4s 2004	76	76	81
N. Y. & Westchester Ltg.	5s 1954	94	93	95½
New York Edison	6½s 1941	113½	112	115½
New York Edison	5s 1944	100½	99½	102
N. Y. Gas & Elec. Lt., Ht. & Pwr.	5s 1948	103½	100½	104½
N. Y. Gas & Elec. Lt., Ht. & Pwr.	4s 1949	88½	86	90½
N. Y. State Gas & Elec.	5½s 1962	99	96	101½
Newport News & Hampton Ry., Gas & Elec.	5s 1944	91	84	93
Niagara Falls Pwr.	5s 1932	101½	100	103
Niagara Falls Pwr.	6s 1932	105	103½	106½
Niagara Falls Pwr.	6s 1950	104	105½	106½
Niagara, Lock. & Ont. Pwr.	5s 1954	109½	104½	110
Niagara, Lock. & Ont. Pwr.	5s 1955	98½	97½	100
Niagara, Lock. & Ont. Pwr.	6s 1958	109½	104½	110½
Norfolk Ry. & Lt.	5s 1949	94	93	95
No. Amer. Edison	6s 1952	100½	96½	102½
No. Amer. Edison	6½s 1948	102½	100½	106
No. Amer. Lt. & Pwr.	7s 1954	98	97	100
North Caro. Pub. Serv.	5s 1934	88	89	93½
North Caro. Pub. Serv.	6s 1954	94	91½	96
North Caro Pub. Serv.	6½s 1944	98	96	100
No. Calif. Pwr.	5s 1948	99	98½	100½
No. Ind. Gas & Elec.	5s 1929	99	97	100
No. Ind. Gas & Elec.	6s 1952	100	99½	103½
Northern N. Y. Utilities	5½s 1949	99	96½	100½
No. Ohio Trac. & Lt.	4s 1933	85	82	87½
No. Ohio Trac. & Lt.	5s 1956	81	78	87
No. Ohio Trac. & Lt.	6s 1926	98	98½	100
No. Ohio Trac. & Lt.	6s 1947	93½	92½	97
No. Ontario Lt. & Pwr.	6s 1931	98	95	99½
No. States Pwr.	6s 1948	101½	101	104½
No. States Pwr.	6s 1941	104	103	107½
No. States Pwr.	5s 1941	95½	93	99½
No. Tex. Elec.	5s 1940	78	80½	82½
Northwestern Elec.	6s 1935	101	101½	102½
Northwestern Pub. Serv.	6½s 1948	99	97½	100½
Ohio Pwr.	5s 1952	92	89½	96
Ohio Pwr.	6s 1953	102	101	104½
Ohio Pwr.	6s 2024	92	88½	95½
Ohio Pwr.	7s 1951	106	106½	107½
Ohio Pub. Serv.	5s 1954	90½	87	93
Ohio Pub. Serv.	6s 1953	100½	98	101½
Ohio Pub. Serv.	7½s 1946	111½	108	112½
Ohio Pub. Serv.	7s 1947	110	107½	111½
Ohio River Edison	6s 1948	102	98½	104
Okla. Gas & Elec.	5s 1950	91	93½	96
Ontario Pwr. of Niagara Falls	5s 1943	99	98	100½
Ontario Transmission	5s 1945	99½	97	99½
Ozark Pwr. & Wtr.	5s 1952	78	75	81
Pacific Coast Pwr.	5s 1940	98	97½	99½
Pacific Gas & Elec.	5s 1942	96½	93½	99
Pacific Gas & Elec.	6s 1941	105½	103½	106½
Pacific Lt. & Pwr.	5s 1951	99	98½	100½
Pacific Pwr. & Lt.	5s 1930	99½	98	100
Pacific Pwr. & Lt.	5s 1953	g96½	....	....
Parr Shoals Pwr.	5s 1952	93	92½	97
Patterson & Passaic Gas & Elec.	5s 1949	100	96	100½
Penn Central Lt. & Pwr.	6s 1953	101½	102	104½
Penn Edison	5s 1946	95	94	97
Penn Elec.	6½s 1954	97	96	99½
Penn Ohio Elec.	6½s 1938	102	99½	103½
Penn Ohio Pwr. & Lt.	5½s 1954	97	95	99½
Penn Ohio Pwr. & Lt.	6s 1939	97	94	99
Penn Pwr. & Lt.	5s 1952	96½	95	98½
Penn Pwr. & Lt.	5s 1953	96½	95	98½
Penn Pwr. & Lt.	6s 1953	104½	102½	105½
Penn Pwr. & Lt.	7s 1951	106	106	107½
Penn Pub. Serv.	5s 1954	93	93	96½
Penn Pub. Serv.	6s 1947	102½	103	105½
Penn Wtr. & Pwr.	5s 1940	100	99½	102
Penn Wtr. & Pwr.	5½s 1953	101½	99½	103
Phila. Co.	6s 1944	103½	101	105
Phila. Co.	5½s 1938	97½	93	100
Phila. Co.	5s 1951	95	95	97
Phila. Elec.	5s 1966	c101½	100	103½
Phila. Elec.	5s 1960	c100	99	103½
Phila. Elec.	5½s 1947	c106	103½	107
Phila. Elec.	5½s 1953	c105½	104	107½
Portland Elec. Pwr.	6s 1947	98½	96½	100
Portland Gen. Elec.	5s 1935	99	98½	100½
Portland Ry., Lt. & Pwr.	5s 1942	87½	84½	92
Portland Ry., Lt. & Pwr.	6s 1947	98½	94	100½
Portland Ry., Lt. & Pwr.	7½s 1946	107½	105½	107½
Potomac Edison	6s 1949	98	96	100
Potomac Edison	6½s 1948	101	99	103½
Potomac Elec. Pwr.	5s 1929	100	99	100½
Potomac Elec. Pwr.	5s 1936	99	98½	100
Power Corp. of N. Y.	6s 1942	99	97½	101
Power Corp. of N. Y.	6½s 1942	102	99½	103½
Power Securities	6s 1949	g82	....	....
Pub. Lt. & Pwr.	5s 1945	75	64	79
Pub. Serv. Co. of Colo.	5½s 1954	92	92	96½
Pub. Serv. Co. of Colo.	6s 1953	99	98	101
Pub. Serv. Co. of Colo.	7s 1933	99	98½	102½
Pub. Serv. Corp. of N. J.	5s 1959	104½	103½	105½
Pub. Serv. Corp. of N. J.	6s 1944	98½	95	99½
Pub. Serv. Co. of No. Ill.	5s 1956	96	91	97½
Pub. Serv. Co. of No. Ill.	5½s 1962	100½	96½	102½
Pub. Serv. Co. of No. Ill.	5½s 1964	100½	96½	102½
Pub. Serv. Co. of Okla.	6s 1949	98	97½	103
Pub. Serv. Elec. & Gas.	5½s 1959	103	98½	105½
Pub. Serv. Elec. & Gas.	5½s 1964	102½	99½	105
Puget Sound Pwr.	5s 1933	98	98½	100½
Puget Sound Pwr. & Lt.	5½s 1949	98	96½	100½
Quebec Pwr.	6s 1953	101	98½	102½
Queensborough Gas & Elec.	5s 1952	99	96½	100½
Queensborough Gas & Elec.	6s 1953	103	101	105
Rio de Janeiro Tram., Lt. & Pwr.	5s 1935	89	85	91½
Robbins & Myers	7s 1946	61	61½	73½
Rochester Gas & Elec.	5½s 1948	102	102	104½
Rochester Gas & Elec.	7s 1946	109	109½	111
Rockford Elec.	5s 1939	99	98	101
Sak River Valley Wtr.	6s 1938	g100	....	....
Salmon River Pwr.	5s 1952	99½	98½	101½
San Antonio Gas & Elec.	5s 1949	96	96	98½
San Antonio Pub. Serv.	6s 1952	101½	99½	104
San Diego Cons. Gas & Elec.	5s 1939	98	98	101
San Diego Cons. Gas & Elec.	6s 1939	101½	99	103
San Joaquin Lt. & Pwr.	5s 1945	98	98	100
San Joaquin Lt. & Pwr.	6s 1950	101½	101	103½
San Joaquin Lt. & Pwr.	6s 1952	101	99½	103½
San Joaquin Lt. & Pwr.	6s 1954	100	99	101
Savannah Elec. & Pwr.	7½s 1941	g104½	....	....
Saxon Pub. Wks. (Germany)	7s 1945	92½	90½	93½
Seattle Ltg.	5s 1949	89	85½	92
Shawinigan Wtr. & Pwr.	5s 1934	100	100	101½
Shawinigan Wtr. & Pwr.	5½s 1950	102	101½	104
Shawinigan Wtr. & Pwr.	6s 1950	104	104	106½
Siemens & Halske	7s 1928	95½	93½	99½
Siemens & Halske	7s 1935	91½	90½	96½
Sierra & San Francisco Pwr.	5s 1949	76	75	80
Sierra & San Francisco Pwr.	6s 1949	90	87	93½
Sioux City Gas & Elec.	6s 1947	100	99	102
Sioux City Gas & Elec.	6s 1949	100	99	102
So. Caro. Gas & Elec.	6s 1942	87	87	93
So. Caro. Gas & Elec.	6s 1932	75	83	88
So. Cal. Edison	5s 1939	99	99½	101
So. Cal. Edison	5s 1944	95	92½	96½
So. Cal. Edison	5½s 1944	101	98½	102
So. Cal. Edison	6s 1943	101½	101	104
So. Cal. Edison	6s 1944	103½	102½	105½
So. Cities Utilities	5s 1931	98	100	102
So. Public Utilities	5s 1943	97	97½	100½
So. Sierras Pwr.	6s 1936	102	102	104½
So. Utilities	6s 1933	100	97½	102½
So. Wisconsin Pwr.	5s 1938	89	88	93
Southwestern Gas & Elec.	5s 1932	96½	94	98
Southwestern Gas & Elec.	6s 1957	96	89	97½
Southwestern Pwr. & Lt.	5s 1943	92½	90	97
Southwestern Pwr. & Lt.	6s 2022	90	88½	94½
Southwestern Utilities	5s 1936	97	96	102
Springfield Ry. & Lt.	5s 1926	99	98½	100½
St. Joseph Ry., Lt., Ht. & Pwr.	5s 1937	92	85½	92
Standard Elec. of Cal.	5s 1939	98	98½	100½
Standard Gas & Elec.	6s 1935	99½	91	101
Staten Island Edison	6½s 1953	104	104	106½
Syracuse Ltg.	5s 1951	101	100½	103
Tampa Elec.	5s 1933	g99	....	....
Tenn. Elec. Pwr.	6s 1947	102½	99½	104½
Tenn. Pwr.	5s 1962	93	90	96½
Tex. Pwr. & Lt.	5s 1937	98	97	99½
Tex. Pwr. & Lt.	6s 2022	95	90	96½
Tide Water Pwr.	6s 1942	99½	98½	101
Tide Water Pwr.	7s 1937	99	97½	101½
Toho Elec. Pwr. (Japan)	7s 1955	89½	87	91½
Toledo Edison	5s 1947	98	97	100
Toledo Edison	7s 1941	109½	108½	110
Toledo Gas Elec. & Htg.	5s 1935	96	97½	100½
Topeka Edison	5s 1930	97	97	100
Topeka Ry. & Lt.	5s 1933	95½	90½	96½
Tri-City Ry. & Lt.	5s 1930	98	96½	99½
Twin State Gas & Elec.	5s 1953	90	84	94½
Tyrol Hydro-Elec. Pwr.	7½s 1955	96½	94½	96½
Union Elec. Lt. & Pwr.	5s 1932	101½	99½	102
Union Elec. Lt. & Pwr.	5s 1933	100	98½	101
Union Elec. Lt. & Pwr.	5s 1954	98½	97½	100
Union Elec. Lt. & Pwr.	5½s 1954	100½	100	104
United Elec. of N. J.	4s 1949	86½	85	88½
United Elec. Lt. & Pwr.	4½s 1929	e98½	98½	99
United Gas & Elec.	6s 1945	97	96	101
United Lt. & Pwr.	5½s 1959	94½	89½	97
United Lt. & Pwr.	6½s 1974	94½	92½	97½
United Lt. & Rys.	5s 1932	95	93½	97½
United Lt. & Rys.	6s 1952	98	95½	100½
United Lt. & Rys.	6s 1973	89	87	92
United Pwr. & Lt.	6s 1944	101	99	103
Utah Lt. & Trac.	5s 1944	87½	83½	91½
Utah Pwr. & Lt.	5s 1944	95	91	98½
Utah Pwr. & Lt.	6s 1944	102	102	104½
Utah Pwr. & Lt.	6s 2022	91	88½	94½
Utica Gas & Elec.	5s 1957	102½	98½	103
Vermont Hydro-Elec.	6s 1929	99	98½	100½
Vicksburg Lt. & Trac.	5s 1932	90	89	93½
Virginian Pwr.	5s 1942	94	88	96
Virginian Pwr.	6½s 1954	100	99	102½
Virginia Ry. & Pwr.	5s 1943	96	93½	99
Wagner Elec. Mfg.	7s	h100½	100	102
Washington Coast Util.	6s 1941	101	99½	101½
Washington Wtr. Pwr.	5s 1939	100½	99½	101½
West Penn Pwr.	5s 1963	99½	93½	99½
West Penn Pwr.	5s 1946	99	93½	100
West Penn Pwr.	5½s 1953	101½	100½	105½
West Penn Pwr.	7s 1946	105½	104½	107½
West Virginia Lt., Ht. & Pwr.	6s 1929	98½	95	100
West Virginia Utilities	6s 1935	96	91	98
Western Elec.	5s 1944	101	98	101
Western N. Y. Utilities	5s 1946	94	90½	97
Western Pwr.	6½s 1954	99½	97	100½
West. States Gas & Elec.	5s 1941	97	95	99½
West. States Gas & Elec.	6s 1947	98	97	100½
Westinghouse Elec. & Mfg.	7s 1931	106½	103½	108½
Wisconsin Elec. Pwr.	5s 1954	96½	93½	99½
Wisconsin Gas & Elec.	5s 1952	98	97	100½
Wis.-Minn. Lt. & Pwr.	5s 1944	94	93	96½
Wis. Ry., Lt. & Pwr.	5s 1933	92½	87½	93½
Wis. River Pwr.	5s 1941	90	88	92½
Yadkin River Pwr.	5s 1941	97½	96½	99½
Yarmouth Lt. & Pwr.	5s 1937	83	82	87
Yarmouth Lt. & Pwr.	8s 1951	98	97	102

Stock Exchange: cChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal. gBid price, low and high, Tuesday, Sept. 1. hLatest quotations available.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

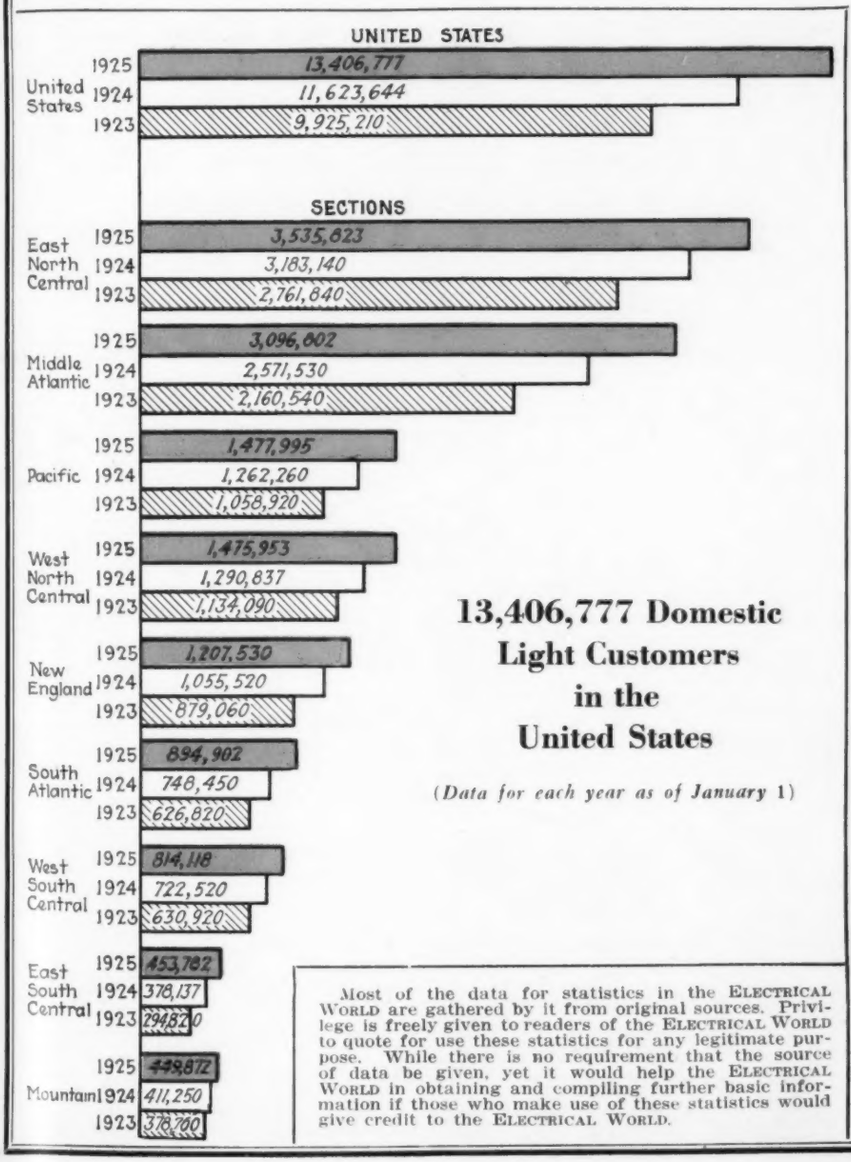
The Home Electrical

THERE are certain items or products which have come to be recognized as essential to the modern home. In a primitive mode of life practically all these would be considered as luxuries, if not absolutely unattainable. Today the little cottage has conveniences which were not accessible to King Solomon in all his glory, and the great palaces and castles of the feudal lords would seem dreary and unlovely to the modern housewife.

Of all the conveniences found in the American home today none is more essential than electric light and power. The built-in tubs, the showers, the parquet floors, the radio and even the telephone might all be taken out of the modern home and living would go on in just about the same way as before. But take out the electric lighting fixtures and the convenience outlets, substituting therefor the candle or the coal-oil lamp, and something very close to domestic chaos would result. Substitute the old sadiron, the broom and the carpet sweeper for the electric iron and the vacuum cleaner, and the joys of modern housekeeping would vanish.

As a result of this weaving of electric service into the fabric of home life, it may truly be stated that today every house constructed within reach of central-station service is equipped for electric light and power. This is reflected in the large increases in the number of central-station domestic lighting customers reported during 1923 and 1924. Both of these years were record ones in domestic building construction throughout the country. Now that the domestic building boom is over and the housing question has largely ceased to be a problem for immediate solution, it is probable that the number of new domestic customers added to the central-station lines during 1925 and in succeeding years will be considerably under the figures for the past two years.

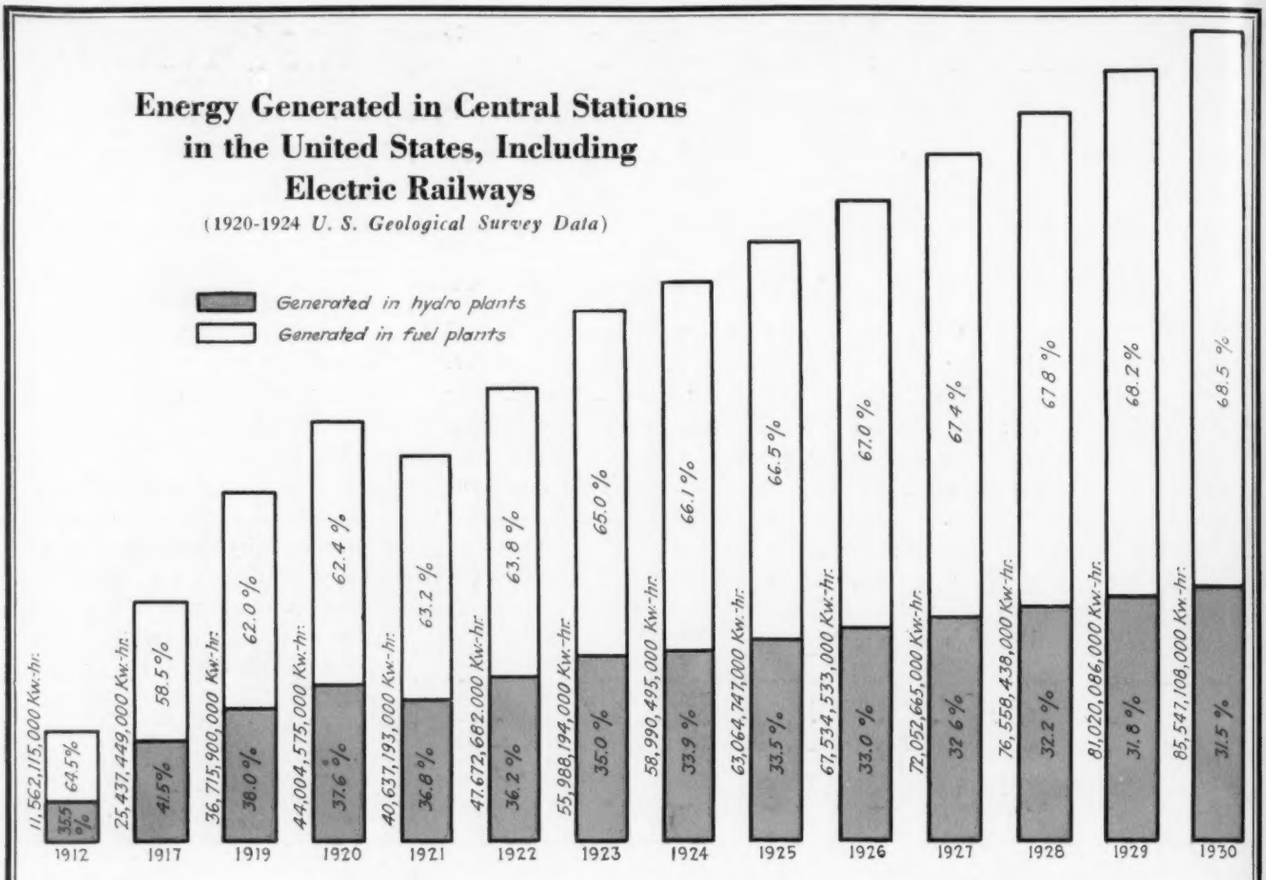
But the future holds large possibilities for the addition of new customers to the central-station lines. Of the approximately twenty-eight million families in the United States today, considerably more than one-half are still using gas or the oil lamp for illumination purposes. These millions of families constitute a challenge to the electric light and power industry. As in the past the industry will meet this challenge with action.



13,406,777 Domestic Light Customers in the United States

(Data for each year as of January 1)

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.



Potential Field of the Industry

THE question is often asked "When is the marvelous growth of the electric light and power industry going to stop?" Here is an industry which since 1912 has more than quadrupled its product and the revenue which it has derived from the sale of that product. Here is an industry the potential activities of which are being extended every year through new industrial and domestic applications. Here is an industry which has at the present time an industrial heating load estimated at not more than 1,200,000 kw., but a potential industrial heating load estimated at 75,000,000 kw., or three times its present connected motor load. The increased use of electrical energy in various chemical processes, the electrification of railroads, the growth in the use of the electric truck, the increased use of domestic heating and motor-driven devices and the increased use of radio in the home all will contribute to the growth in the central-station output and revenue expected of the future. The placing of hundreds of thousands of radio receiving sets on the central-station lines will be an actuality of the near future, and it is estimated that by 1930 the central-station industry will derive an annual revenue of seventy million dollars from the radio load alone.

It would take a seer indeed to prophesy the ultimate limits of central-station activity or even to foresee when the present rate of annual growth is going to decrease. It is within the limits of human thought to arrive at a fairly clear conclusion as to the ultimate number of domestic and commercial lighting customers, and even the number of power customers, but one might as well try to estimate the grains of sand on the seashore as to foretell the ultimate limits to the use of electrical energy in this country.

A certain trend has been established, however, which gives a fair basis for predicting the activities of the industry as far ahead as 1930. Using this basis, it is believed that the energy generated by the public utilities of the country will increase from 58,990,495,000 kw.-hr. in 1924 to 85,547,108,000 kw.-hr. in 1930, or a 45 per cent increase for the six-year period. These figures include energy generated by purely electric railway companies as well as by electric light and power companies. The rate of hydro-electric growth is also fairly well established. In 1924 approximately 34 per cent of total electrical output was generated in hydro-electric plants and 66 per cent in steam plants. In 1930 it is estimated that the proportionate amount of energy generated in hydro-electric plants will have decreased to 31.5 per cent and that generated in steam plants increased to 68.5 per cent.

Only one thing is certain as to the future growth of the electric light and power industry—its ultimate range of activities will not come in the lifetime of the present generation.